HETCH HETCHY WATER AND POWER DIVISION

SEPARATION STUDY

AND

POWER DIVISION COST AND RATE ANALYSIS

FOR

CITY AND COUNTY OF SAN FRANCISCO

By

ROY A. WEHE

Consulting Engineer

San Francisco, California

August 1, 1955

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CONSULTING ENGINEER
PACIFIC MUTUAL BUILDING
660 MARKET STREET
SAN FRANCISCO 4, CALIFORNIA

August 1, 1955

Mr. H. E. Lloyd, Manager and Chief Engineer,
Hetch Hetchy Water Supply,
Power and Utilities Engineering Bureau,
City and County of San Francisco,
San Francisco, California.

Subject: Hetch Hetchy Water and Power Divisions
Separation Study and
Power Division Cost and Rate Analysis

Dear Mr. Lloyd:

In conformity with your assignment, there is submitted herewith my study and report on the above subject. It is my belief that you will find the analysis made to be complete and to conform with good and acceptable engineering practice as applied to work of this character.

The work done has been assembled under five Chapters, namely:

I - Introduction
II - Cost Separation of Water and Power Functions
III - Earning Position of Hetch Hetchy Power and Water Divisions
IV - Cost Allocations to Classes of Power Service
V - Rate Analysis
VI - Conclusions and Recommendations

Considerable study has been devoted to the Separation of the Water and Power plant investments, as well as their annual costs of operation. The analysis shows that the Water Supply Division is the marginal function at this stage and use of the Project's development. It is held that, in a multiple-purpose project, the individual functions must share in the burdens as well as the benefits of the project as a whole, to the end that no one function may be assigned greater cost burdens than the resulting benefits. The application of these broad economic principles has resulted in the need of the Power Division carrying a substantially greater portion of the jointly used facilities than the Water Division.

In the Chapter on earnings, the results from the cost separation of the Divisions are utilized, along with revenues at present level of charges. For the 12-month period ended June 30, 1953 - adjusted, the relation of net earnings to depreciated plant capital is as follows:

	Power	Water	System
Rate of Return	4.35%	3.76%	3.97%

[illegible]

[illegible]

Mr. [illegible]
Public Utility [illegible]
Power and [illegible]
City and County of [illegible]
San Francisco, California

Subject: [illegible]

Dear Mr. [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

The heart of the study, from the standpoint of the Power Division, is the results realized from the extensive cost analysis and cost allocations as between each of the classes served. Costs are developed for the Municipal, Irrigation Districts, and Commercial loads. As would be expected, the results indicate that, for some classes, the revenues collected conform reasonably well to the indicated costs - for others, the revenues are low - and for some, high - when measured on a cost basis. For example, Railway rates are fairly close to costs; while service to the Airport and to the many City Departments of the Municipal Government, are furnished below Project costs. Revenue from the Crystal Springs Pumps is very favorable.

For the Modesto Irrigation District, revenues are less than developed costs to serve.

Under the Commercial classification, while the Riverbank Ordnance Service is not financially profitable, the earnings realized on the much larger sales to the Permanente Cement plant are very satisfactory.

In the study there is developed what the Power Division revenues would be if competitive rates were applied. For the Municipal and Commercial loads, this is interpreted to mean the application of Pacific Gas and Electric rates - and for Modesto Irrigation District, rates from the Bureau of Reclamation. The increase in revenue, under alternate rates, is estimated at something over 550, 000 dollars, or 14 per cent.

In the Chapter on rates, decisions as to the level of the rates selected have been influenced by an endeavor to have such selections conform to contracts arising from the Raker Act, as well as the Act itself - to an appraisal of the public interest viewpoint of a Municipal Corporation, as well as to the more technical aspects, as represented by both the value and the cost-to-serve viewpoints. You will find that the recommendations encompass leaving some rates as now charged - for others, the adoption of different rates. The suggestion is also made that, in the case of some of the Municipal services, if it be the decision to make no increase, then a plan might be considered wherein, from an accounting standpoint, the Power Division would be credited with the higher revenue differential that is not charged.

The application of the proposed rates would call for an over-all increase in System Power revenues somewhat under 300, 000 dollars, of which approximately 53 per cent would be assessed against the Irrigation Districts, and the remainder would be paid by the City's own Municipal Departments. The study shows that such an increase in revenue would yield a Power Division rate of return of 5. 1 per cent.

It is the view that many aspects of this whole analysis will be helpful in pointing the way to the solution of many problems - both accounting and engineering - that are constantly arising - and especially where an expanding Power system is contemplated. Further, in reference to rates and proposed rate changes, the results developed and the recommendations made are worthy of careful consideration where future changes in rates charged for Hetch Hetchy Power Service are involved.

In the preparation of this study, acknowledgement is made to the many who assisted in making available the large amount of factual data, as well as giving help in providing the basic fundamentals as to Project operation. Mention should be made of William J. Dwyer, in charge of Accounting and his Assistant, Howard Emberling, for capital and expense figures; to B. A. Devine, Chief Engineer of the Bureau of Light, Heat and Power, and his Assistants, for rate billings and load data. In your own immediate Department, to yourself; to B. W. Grethel, Engineer of Operations at Moccasin; to R. S. Hansen, Senior Civil Engineer; to F. L. Re Qua, Senior Electrical Engineer, for his constant and helpful co-operation, and to his able Assistant, C. D. La Fleur who, with Mr. Re Qua, made available much of the factual engineering data. Mention should also be made of P. Arnstein of John F. Forbes & Company, for his helpful co-operation in accounting matters.

I have appreciated the opportunity of making this study for the City and County of San Francisco and have enjoyed the association. If there is further work to be done on this or related projects, I shall be glad to undertake such assignments.

Respectfully submitted,

Roy A. Wehe.

RAW:w

Roy A. Wehe

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CHAPTER I

INTRODUCTION

HETCH HETCHY WATER AND POWER DIVISIONS

SEPARATION STUDY

AND

POWER DIVISION COST AND RATE ANALYSIS

By

ROY A. WEHE
Consulting Engineer

CHAPTER I

INTRODUCTION

Purpose And Scope Of Study:

The primary purpose of this review and study is to make an analysis of the indicated costs associated with the operation of the Power Division of the Hetch Hetchy Project, and the rates and charges that may reasonably be required to provide such service, keeping in mind the requirements under which the Project operates.

To realize the development of the major objectives, it is first necessary to study the operations of the whole Project, and to make a separation as to the plant investment and expenses of operation as between the two Divisions of Power and Water Supply.

After making the separation, the basic financial material is

available to explore the earning position of each of the two Supply Divisions under present customer rates and revenues. Such a review is incorporated in the report.

The over-all costs of providing the Power Division is broken down by the different classes of customers served.

Rates and charges that are viewed as appropriate, under the premises, are set forth for Management's review and consideration.

It may be further noted that the costs used reflect the charges resulting from the Agreement between the City and County of San Francisco and the Pacific Gas and Electric Company dated March 14, 1945, with supplements.

This is the Agreement in which the charges are provided for payment by the City to the private Utility (Pacific Gas and Electric Company) for transporting, delivering, and metering the City's Hetch Hetchy energy from Newark to its Municipal loads.

Period Of Study:

The year of study is for the 12-month ending June 30, 1953. However, such recorded results have been adjusted to a pro forma year of the same period, in order to reflect two changes that have subsequently occurred. The first adjusts for the very large reduction in sales to a large Commercial customer (Kaiser Aluminum & Chemical Corporation); and the second makes an adjustment for the more favorable Wheeling Charge for the City's electric energy delivered to the San Francisco International Airport.

Outline Of Study:

For convenience and orderliness of presentation, the report is

set up under six Chapters and an Appendix, as follows:

An Appendix is made a part of the report, incorporating supporting information and data to the principal Chapters.

Historical Background:

The Hetch Hetchy Development is a multiple-purpose project. The asserted objective was to make available to the people of San Francisco an adequate water supply and one of the highest purity. Power development was viewed primarily as a means to help support the Project and to utilize, for the beneficial use of the people, the power potential in the water supply.

First construction started on July 8, 1914, on a roadway. With the completion of the first section of the O'Shaughnessy Dam in May 1923, the Hetch Hetchy Reservoir was formed. In August 1925, power deliveries were first made to Newark from the Moccasin Power House and transmission line just completed. In 1934, the water acqueduct from Moccasin was completed, and the first mountain water flowed into Crystal Springs Lakes on the Peninsula in October of that year.

Raker Act: (H. R. 7207)

With no intention of covering the many phases of the Act, the following is presented as indicative as to the general nature of the Act

and a few of its conditions.

A Congressional Grant, known as the Raker Act, was passed in 1913 which grants to the City and County of San Francisco certain rights-of-way and the use of public lands in Yosemite National Park, Stanislaus National Forest, and elsewhere, for the purpose of constructing, maintaining, and operating reservoirs, dams, conduits, power and electric plants, pole lines, and other structures.

The City is required to recognize the rights of Modesto and Turlock Irrigation Districts to receive from the natural daily flow of Tuolumne River certain waters as can be beneficially used by them. It is further required to construct certain roads and trails and donate them to the Federal Government; pay an annual fee to the Federal Treasury; as well as to proceed with certain construction - including storage reservoirs -; and the development of power for Municipal and Commercial use. As to the latter, the City and County is prohibited from ever selling or letting for resale purposes the electric energy to any corporation or individual, except a Municipality or a Municipal Water District, or an Irrigation District.

Section 9 (i) requires the City to sell or supply at cost to the Modesto and Turlock Irrigation Districts, or to Municipalities within either District, power for pumping and Municipal purposes available in excess of San Francisco's own requirements for the same purposes, after which any surplus remaining may be sold for commercial purposes.

Sections 9 (m) and (n) provide, among other things, that the prices and/or rates and charges for sale, other than for Municipal purposes, shall conform to the Laws of the State of California or, in the absence of

such statutory law, at prices approved by the Secretary Of the Interior.

Since the City's transmission lines from its Moccasin Power Plant terminated in a foreign substation outside the City and County of San Francisco, it was necessary to contract for the delivery of such energy to the City's Municipal loads. Pacific Gas and Electric Company was the designated Agency that performed the service.

The character of the Agreements lead to controversy and Court action with the Secretary Of the Department Of The Interior. The interpretation placed on the requirements of the Raker Act by the Secretary prevailed and, in 1945, a series of agreements were made and authorized which have carried through and are still effective, with certain supplements and amendments. Since this phase of the Raker Act requirements directly affects the costs of Hetch Hetchy electric energy; the price paid for Supplemental Power purchases; the rate charged for the Irrigation and Commercial sales, as well as Power load assignments to the City; the contracts will be listed. Initially, there were five, namely:

(1) With the Modesto and Turlock Irrigation Districts for purchase of Hetch Hetchy energy (initial contract dated March 2, 1945). The Modesto District acts as Agent for the Turlock District in actual operation.

(2) With Pacific Gas and Electric Company for delivery of Hetch Hetchy energy from Newark Substation to the various Municipal services. This agreement, which is dated March 14, 1945, is commonly spoken of as the "Main Contract" and at times is referred to as the "Wheeling Agreement". This contract also provides for Supplemental Power purchases for the City's own

Municipal uses and for purpose of meeting its obligations to the Irrigation Districts.

(3) With Pacific Gas and Electric Company for assignment to the City under its contract to serve Permanente Cement Company.

(4) With Pacific Gas and Electric Company for assignment to the City under its contract to serve The Permanente Metals Corporation - (in a Supplemental Agreement, the customer's name became Kaiser Aluminum & Chemical Corporation).

(5) With Pacific Gas and Electric Company for lease of Pacific Gas and Electric Company's transmission facilities that are used to supply Permanente Cement and Kaiser Aluminum. The Agreement also provides for the purchase of Supplemental Power to supply their loads by the City above that available from Hetch Hetchy.

Subsequent Agreements have modified and/or extended the initial Agreements as to both terms and expiration dates.

In addition, the City now serves a Commercial power load at Riverbank which is operated by Norris-Thermador Corporation for the Ordnance Department of the United States Government.

To make up the deficiency in Hetch Hetchy Power deliveries to the Riverbank Plant, a letter agreement with Pacific Gas and Electric Company dated February 8, 1952 provides for Supplemental Power purchases.

Physical Plant:

In brief form and with emphasis on the Power Division, it may be said that the heart of the Project is centered in its large Hetch Hetchy Storage Reservoir formed by the Construction of O'Shaughnessy Dam, the

Moccasin Power Plant, and the connecting waterways. The means of conveying the water supply to San Francisco through 150 miles of mountain tunnels and pipe lines was the most difficult and costly part of the Project.

The accompanying two maps, which show the general layout and profile of the Hetch Hetchy Project, will be helpful in visualizing its location and the relationship of its many parts, one with another.

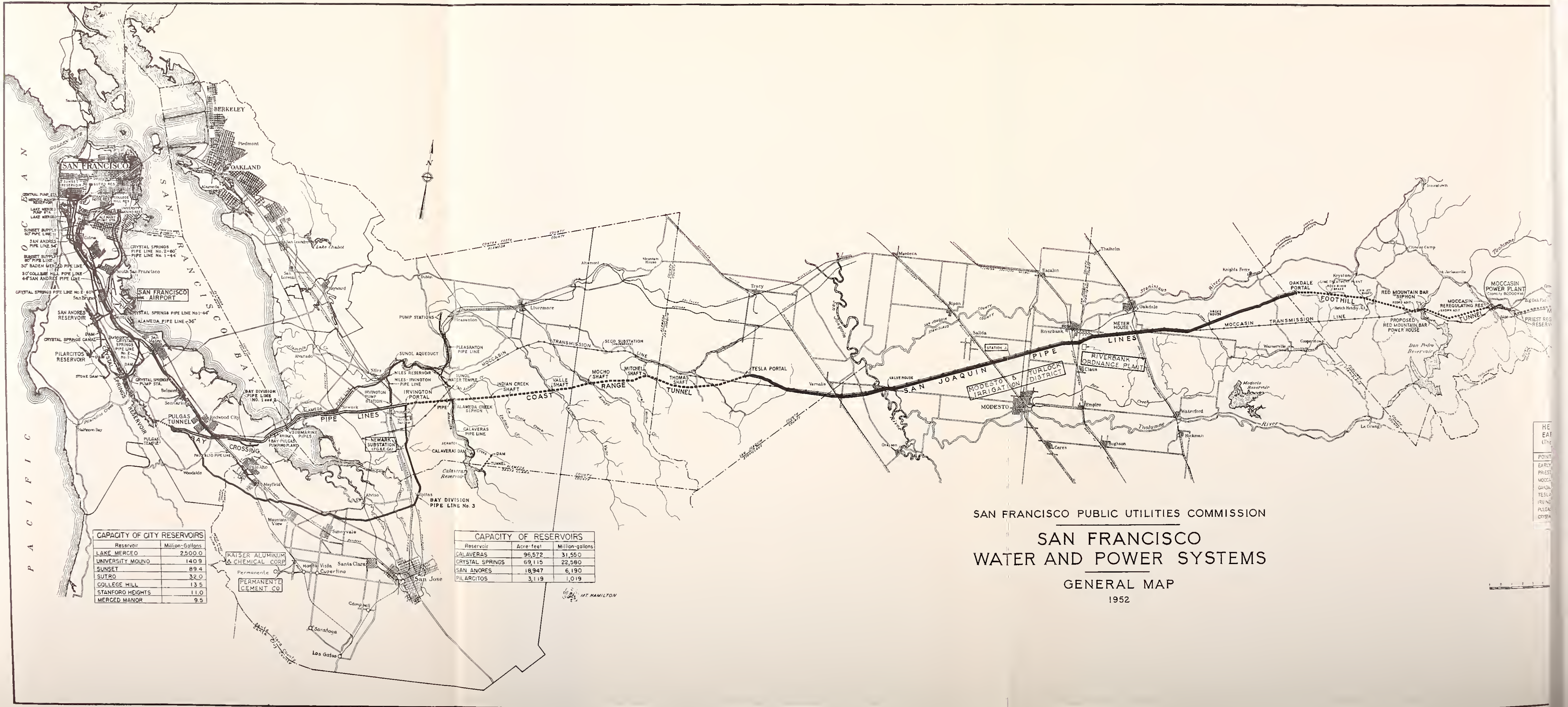
The O'Shaughnessy Dam was originally built in 1923 to a height of 344.5 feet and formed a storage reservoir of 260,000 acre feet, at an investment of over 10.5 million dollars. It was raised to 430 feet in 1938 at an additional investment of 4.5 million dollars. The storage was increased to 360,000 acre feet.

A second storage reservoir was formed by the construction of Lake Eleanor Dam. Its capacity is 27,600 acre feet. It was built primarily to provide water for the operation of Early Intake Power House, which had an installed capacity of 3000 Kva, later increased to 3750 Kva. Its original purpose was to provide the necessary power for the construction of O'Shaughnessy Dam.*

A third storage dam at the head of Cherry River is now under construction and is not a part of this study.

The Moccasin Power Plant has four impulse type water wheels of 25,000 horsepower each, connected to four 20,000 KVA generators that generate at 11 Kv. At the switching station at the Powerhouse, the voltage is stepped up to 115,000 and transmitted 98.6 miles over a double circuit steel tower transmission line, to the Pacific Gas and Electric Substation at

* Early Intake Power Plant is still operated, though written off through depreciation. It is connected to Moccasin over a 22 Kv line.



CAPACITY OF CITY RESERVOIRS	
Reservoir	Million-Gallons
LAKE MERCED	2,500.0
UNIVERSITY MOUND	140.9
SUNSET	89.4
SUTRO	32.0
COLLEGE HILL	13.5
STANFORD HEIGHTS	11.0
MERCED MANOR	9.5

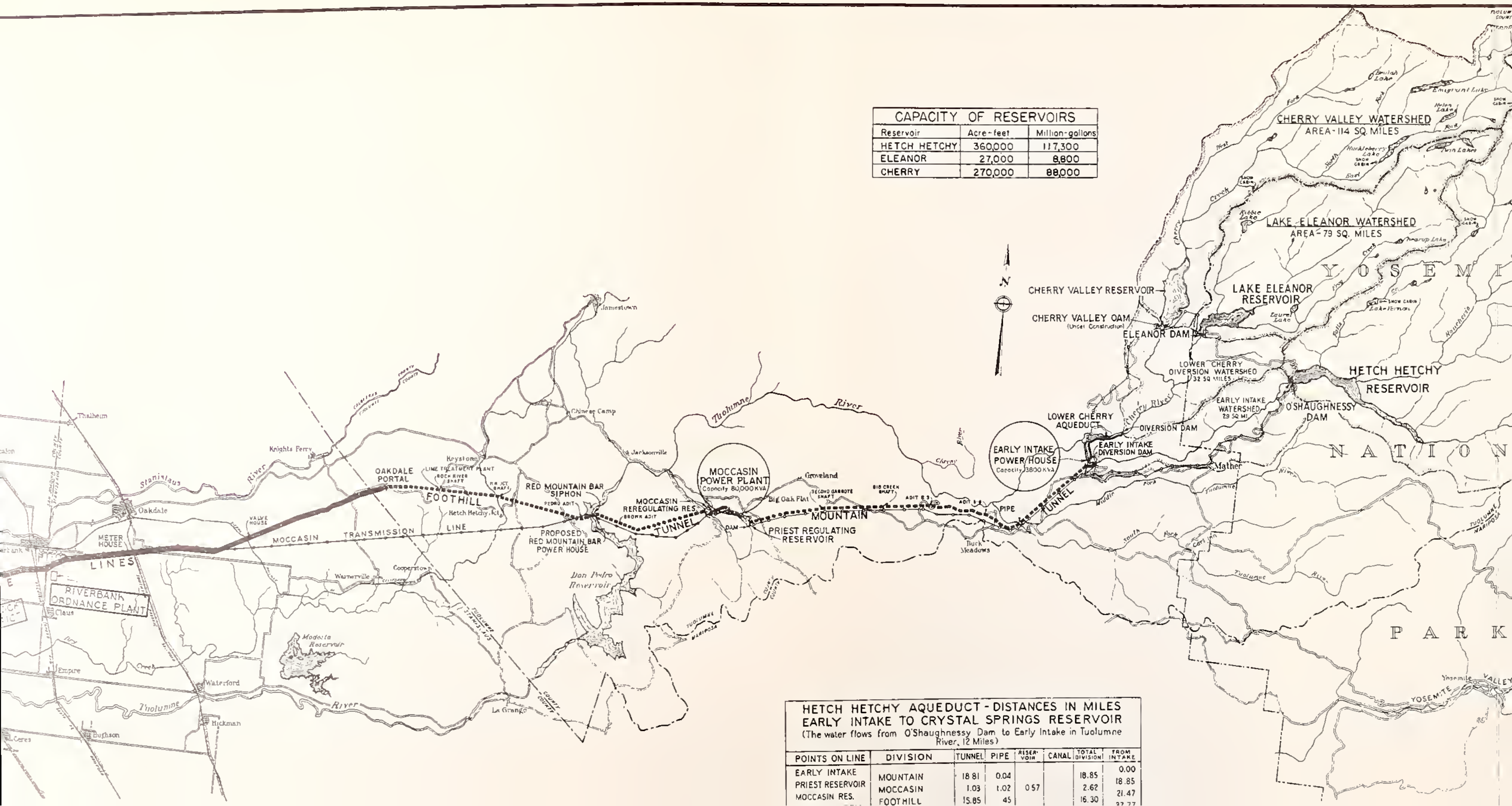
CAPACITY OF RESERVOIRS		
Reservoir	Acre-feet	Million-gallons
CALAVERAS	96,572	31,550
CRYSTAL SPRINGS	69,115	22,580
SAN ANDRES	18,947	6,190
PILARCITOS	3,119	1,019

SAN FRANCISCO PUBLIC UTILITIES COMMISSION

SAN FRANCISCO WATER AND POWER SYSTEMS

GENERAL MAP

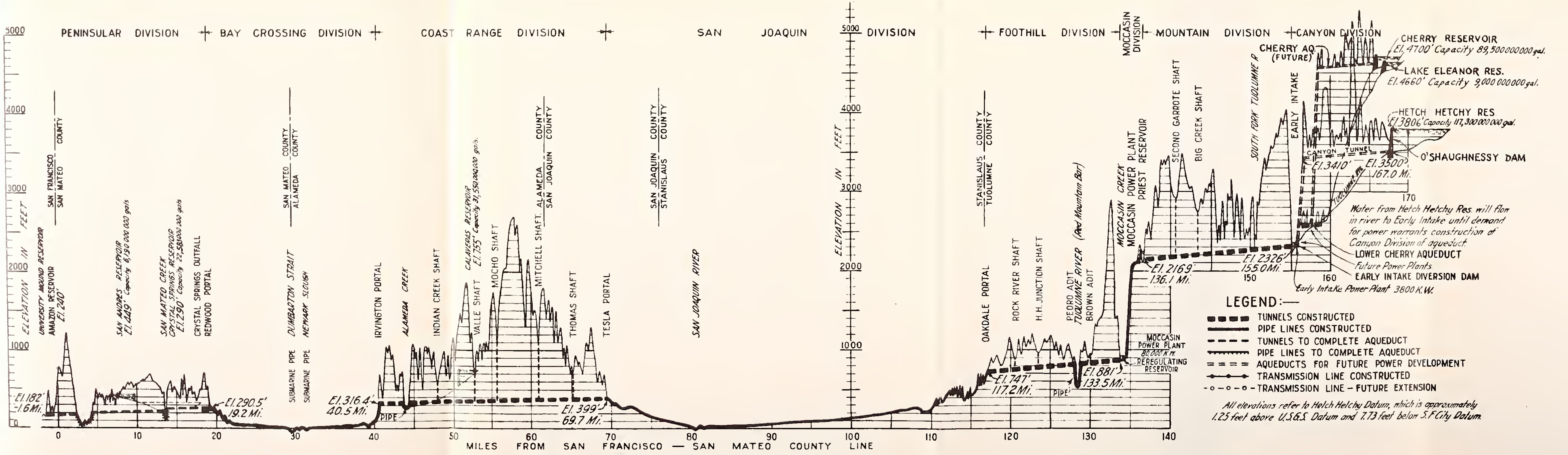
1952



CAPACITY OF RESERVOIRS		
Reservoir	Acre-feet	Million-gallons
HETCH HETCHY	360,000	117,300
ELEANOR	27,000	8,800
CHERRY	270,000	88,000

HETCH HETCHY AQUEDUCT - DISTANCES IN MILES
EARLY INTAKE TO CRYSTAL SPRINGS RESERVOIR
(The water flows from O'Shaughnessy Dam to Early Intake in Tuolumne River, 12 Miles)

POINTS ON LINE	DIVISION	TUNNEL	PIPE	RESERVOIR	CANAL	TOTAL DIVISION	FROM INTAKE
EARLY INTAKE							0.00
	MOUNTAIN	18.81	0.04			18.85	
PRIEST RESERVOIR							18.85
	MOCCASIN	1.03	1.02	0.57		2.62	
MOCCASIN RES.							21.47
	FOOTHILL	15.85	45			16.30	
							37.77



SAN FRANCISCO PUBLIC UTILITIES COMMISSION

SAN FRANCISCO WATER AND POWER SYSTEMS
PROFILE OF AQUEDUCT LINE

Newark. Maximum economical capability of Moccasin on peaks is found to be 82,000 Kilowatts.

The Moccasin Plant operates under a static head of approximately 1316 feet. The water, on release from Hetch Hetchy Reservoir, flows down the open Tuolumne River channel to the Early Intake Diversion Works, 12 miles below and at the head of the 18.8 mile Mountain Tunnel, constructed at a cost in excess of 15 million dollars. From the Tunnel, water is stored in the Priest Reservoir (formed by construction of an earth-filled dam), with a capacity of 2350 acre feet, which acts as the forebay to the Power Plant below. Water discharged from the Priest Reservoir enters the Moccasin Power Tunnel (5346 feet in length) and passes through an inlet tower, surge chamber, and into penstock lines that are over a mile in length, to the Power House.

Below Moccasin Power House is pondage created by the discharge from the Power House and held by the construction of Moccasin Dam. From the Afterbay Storage, water passes through a control tower into the Foothill Tunnel on its long way to the Bay Area. Part of the water is, however, delivered to the Don Pedro Reservoir of the Irrigation Districts from the Red Mountain Bar Siphon.

The run-off from the Moccasin Creek is excluded from the Afterbay Reservoir by a small dam on Moccasin Creek ahead of the Power House, and necessary by-pass conduit, in order to protect the water supply from any possible contamination.

The Tunnels and pipe lines, starting with the Foothill Tunnel, are used by the Water Division and have an investment of over 68 millions of dollars.

Investment and Extent of Hetch Hetchy Operations:

In order to provide a brief view of the magnitude of the Project's operations, the following is presented, based upon the financial statements of the Department:

Plant Investment: (Balance Sheet as of June 30, 1953)

Water Division	$107,923,088
Power Division	13,094,838
Total	$121,017,926

Operating Statement: (Year ended - June 30, 1953)

Operating Revenues:	
Sales of Electric Energy	$ 4,617,981
Sales of Water to S. F. W. D.	3,545,675
Total Operating Income	$ 8,163,656
Operating Revenue Deductions:	
Operating Expenses	$ 2,850,081
Depreciation	1,710,305
Taxes	20,240
Fees to U.S. Government	30,000
Total Operating Revenue Deductions	$ 4,610,626
Utility Operating Income	$ 3,553,030*

Wholesale water deliveries are made to the San Francisco Water Department for resale.

* Exclusive of "Other Income" made up of adjustment of $277.36 and non-operating Revenue of $62,599.16.

Electric energy deliveries and sales are made to satisfy all of San Francisco's Municipal requirements; to the Modesto and Turlock Irrigation Districts; to three Commercial customers; and, to a limited extent, sales in Tuolumne County, to the City's Recreation Park - known as Camp Mather. There may also be small dump power deliveries made to Pacific Gas and Electric Company. More specifically, the classes of service to which electricity is furnished are as follows:

I - San Francisco Municipal Loads:

1 - Railway - A. C.

2 - Railway - D. C.

3 - Street Lighting

4 - Traffic Signals

5 - Crystal Springs Pumps

6 - All Other Loads

a - Airport

b - Balance of Municipal

II - Irrigation Load:

1 - Modesto and Turlock

III - Commercial Loads:

1 - Riverbank Ordnance Plant

2 - Permanente Cement Plant

3 - Kaiser Aluminum Plant

IV - Other Loads:

1 - In Tuolumne County

2 - Dump Sales to Pacific Gas and Electric Company.

Total recorded sales for the year ending June 30, 1953 were in the amount of 625,864,808 Kilowatt hours. Of this, San Francisco Municipal use

(exclusive of that in Tuolumne County)took 191,186,890, or 30.5%; the Irrigation Districts, 21.8%; Commercial Loads, 47.6%; and Other loads 0.1%. There were no dump sales to Pacific Gas and Electric Company.

With this introductory review of the Hetch Hetchy Project, it has been the intention to provide a general background as to the nature and extent of Project Operations. In subsequent Chapters, the study proper will be undertaken, analyzed and developed.

CHAPTER II

COST SEPARATION OF WATER AND POWER FUNCTIONS

CHAPTER II

COST SEPARATION OF WATER AND POWER FUNCTIONS

General:

This section of the study has for its purpose the cost separations of the power and water functions in the Hetch Hetchy Water and Power Project. This is an important step inasmuch as the resulting assignments determine the over-all financial burden that each of the two functions must support through revenues derived from power and water sales. In this section of the study both the Water and the Power functions have been given equal attention, even though the ultimate objective of this analysis is directed to the Power end.

Need For Separation Of Functions:

In a multi-purpose project, such as represented by Hetch Hetchy, there is much of the investment and the annual costs incurred that are utilized for both the Water and Power function. It is plain that the impounding of the water back of the O'Shaughnessy Dam in the Hetch Hetchy reservoir and the water course made by the mountain tunnel from Early Intake to the Priest re-regulating reservoir, as well as many other facilities such as the shops and housing quarters at Moccasin and the Supervisory personnel, are in large measure common to the operation of both the project functions. It is also true that the resulting water and electric services are distributed to different segments of the population, who utilize these differently and in widely differing amounts. Thus it becomes desirable, from an economic and financial standpoint, to separate and to allocate the costs that are incurred as between the Water and Power functions on some reasonable and rational basis. This latter is the purpose of this

section.

Cost Allocation - General:

Cost allocation is the process of apportioning project costs among the various purposes served by the project. The objective of a cost allocation is to distribute project costs equitably among the purposes served*. In this section of the study, the purpose is to determine how much of the capital and annual costs are properly chargeable to water supply and how much to power. The problem is one that confronts engineers in many different fields of endeavor. It has come into particular prominence, in modern times, in connection with the large-scale development of multi-purpose dams and reservoir projects built by the Federal Government and also by States and Municipalities.

Allocation Theories On River Basin Projects:**

One of the fundamental tenets of a River Basin allocation is that costs of a multiple-purpose project shall be allocated among the purposes served in such a manner that each purpose will share equitably in the savings resulting from combining the purposes in a multiple-purpose development.

Several methods of cost allocation have been devised for water,

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* Taken from a printed report (Green Book) prepared by a Federal Subcommittee on Benefits and Costs on the General Subject of "Proposed Practices for Economic Analysis of River Basin Projects" and submitted to Federal Inter-Agency River Basin Committee - under date of May 1950.

** River Basin allocation practices - or perhaps a more expressive term, "Separations" as between water and power, in the case of the instant project - should not be confused with allocations of cost into its primary components, as utilized in a subsequent section of this report, as a basis for rate fixing.

power and other resource developments. Three of these methods are, at present, in general use by the principal Federal Agencies* that are concerned and that have the responsibility of control of such Federal projects. The methods recommended are:

(1) The Separable Costs - Remaining Benefits Method.

(2) The Alternative Justifiable Expenditures Method.

(3) The Use Of Facilities Method - sometimes known as the Proportionate Use Method.

The first two methods allocate joint costs to the functions in proportion to the cost of providing for these functions as determined by a reasonable alternative means but, at the same time, as limited by the value of the benefits produced by each. While the first method is generally considered preferable for general application, the second method differs from the first only in employing Specific costs of the various functions rather than their Separable costs. The third method is the simplest, and would allocate joint costs in proportion to the use which is made by the different functions of the project. It is particularly suitable for irrigation problems where water carried by pipe lines and canals is ultimately distributed to different water users. Allocation of the joint facilities is made in relation to the relative volumes of water. However, where the value of water per unit volume is not the same for the different functions - such as in a water and power project - one of the first two methods is preferable.

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* In accordance with a press release, dated April 6, 1954, an agreement on a system of allocation of costs of multiple-purpose water resource projects has been reached by the Department Of The Interior, the Depart- Of The Army for the Corps Of Engineers, and the Federal Power Commission. A copy of the release is made a part of Appendix A-1.

This brings up the question of value or benefits - terms that lie close to the logical foundations of most rational methods of river basin cost allocations. One of the earliest methods of allocation was, in fact, known as the "benefit theory". In this method, the "joint costs", i.e., all project costs that cannot be recognized as pertaining to specific uses such as for municipal water supply, power, irrigation, and others - are pro-rated to the several project uses in proportion to the benefits estimated or to be received. It is now generally recognized that a more significant allocation would be one not geared to gross benefits, but to net benefits - the latter being obtained by subtracting from the gross benefits the recognized Separable or Specific Costs.* Joint costs are then pro-rated among the various uses or project functions in the ratio of the net or remaining benefits. This, in effect, is the general procedure under the first two methods and is the method used in this study - utilizing however Specific, rather than Separable, costs.

The Hetch Hetchy Project - A Going Concern:

Many of the River Basin studies, at Federal level, involve a

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* Separable costs and Specific costs are not necessarily, and generally are not, the same.

Separable costs are related to each project function and represent the difference between the cost of a multiple-purpose project and the cost of the project with the purpose omitted. Specific costs, as used in this study, are associated with those of physically identifiable facilities that are serving only one of the project's functions.

It may be noted that the sum of the Specific costs by functions will equal the total of the multi-purpose project costs - while the sum of the Separable costs will generally exceed the actual project cost - if the multi-purpose project is economically feasible. In this study, Specific costs are used - rather than Separable costs.

determination of the economic feasibility of an unbuilt project. Such studies may encompass a complete analysis of possible alternate projects. Some of the functions of a Federal multiple-purpose project may be fully reimbursable to the Federal Treasury; others partly; and some not at all. There are involved the determination of the periods of repayment, and many allied problems, wherein costs must be equated over the economic life of the project.

In the instant study, the analysis deals with a project that has been in operation many years. It is a project built and operated by the City and County of San Francisco under a Congressional Grant known as the Raker Act. Under that Act, certain privileges and restrictions are imposed. For instance, priority of use of water and electic energy delivered from the Hetch Hetchy Project is provided for, as well as the basis of the charges for the service.

Generally it is interpreted that the Act provides that sales of electric power to the Modesto and Turlock Irrigation Districts for municipal and pumping purposes, shall be based primarily on costs of providing such service. In this respect (Section 9(e)) of the Act states, in part:

> "- - - at such price as will actually reimburse the said (Hetch Hetchy Project) for developing and maintaining and transmitting the surplus electrical energy thus sold - -".

Again, in the same section, under paragraph (m), the wording is:

> "- - - said prices not to be less than will return to said grantee the actual total costs of providing and supplying said power, which costs shall be computed in accordance with the currently accepted practice of public cost accounting, as shall be determined by the Secretary Of The Interior, including, however, a fair proportion of cost of conduit, lands, dams, and water supply system- - -".

For sales for commercial purposes, the rates and charges must

conform to the laws of the State of California or, in the absence of such statutory law, be subject to the approval of the Secretary Of The Interior.

Separation Of Power And Water Function:

The investment and cost division as between the two functions is, in part, dependent upon whether the project be viewed as it presently exists, or whether a long-time range of the power and water supply be taken.

Both the power production and water deliveries will unquestionably be substantially increased over present day capabilities through enlargement of the Project facilities in the years ahead. The pattern of such development may be subject to change. The current problem is to determine costs* that are indicative of present operations - which, in turn, may be helpful in setting the current rate level for the services now marketed. For this purpose, the recorded cost basis is used.

One important element in any cost determination is the interest rate used. This is frequently spoken of as the return compenent of annual costs.

In this analysis it first appears as an interest component in the River Basin separation. Interest on plant capital, less the reserve

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* In calculations involving comparative costs over a future time period, the sinking fund method for determining the depreciation burden is normally used. That was also the method initially used in this study. However, it was found that the developed allocation ratios, as between the Power and Water functions for the assignment of joint facility costs were very nearly the same - whether the sinking fund or the straight line methods were employed. Since the earning position is computed on the book basis - that utilizes the straight line method - this latter method has been used throughout this study in order to provide harmony in the separation and Earning analyses.
Fixed capital in service, depreciation reserve accruals, and annual depreciation expense amounts for the fiscal year ending June 30, 1953, were made available by Hetch Hetchy Water Supply Power and Utilities Engineering Bureau, through John F. Forbes and Company, Certified Public Accountants.

for depreciation is taken at 4* percent per annum.

In the Chapter that follows, on the relative Earning Position of each of the two Divisions, the return component is developed for each of the two functions as the relationship between the net revenues (gross revenues less project expenses) and the net plant capital - after the joint investment and joint expenses have been folded into each of the two Divisions - as a result of the River Basin allocation. The actual rate of earnings so developed turns out to be 3.97 per cent, compared to the 4 per cent used as the interest rate. The two rates need not be, and generally would not be the same, due to differences in the time period though, in this instance, the two rates are almost identical.

Attention should also be directed to the treatment of bond redemption. Costs in this study do not make provision for bond retirement. The cost to serve element is intended only to provide for the carrying charges on plant investment - i.e., interest or return, and depreciation - and not the amortization of that investment. Rates for customer service, as established by State and Federal Commissions, and as those have been passed on by the Courts, normally do not provide for more. However, the burden imposed by bond retirement is reviewed. In River Basin studies made by Federal Agencies, where plant investment amortization is provided, the provision for depreciation is limited to a nominal amount for interim replacement of the shorter life facilities - so, in effect, there is no duplication in costs provided.

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* An effective interest rate of 4.12 per cent for bond money covering all issues from 1909 through the September 21st issue of 1950, was also developed by the John F. Forbes and Company. Likewise, a rate of 3.61 per cent was developed on the bonds for that period outstanding as of June 30, 1953.

A - Procedure in Development Of The Cost Allocation:

There are two principal parts in this development, namely:

1 - Separation of plant capital and expense as between Water and Power through the application of use made, function performed, and the time spent as between the Water and Power functions.

These include:

a - Plant capital and expenses expended entirely for one function, such as:

(1) Moccasin Power Plant - for Power

(2) Coast Range Tunnel - for Water

b - Joint expenses normally allocated by individual analyses such as supervision and engineering, station expenses, maintenance of structures, administrative and general, and similar expenses.

2 - Jointly used plant facilities and expenses incurred that are of such a nature that each is related to the whole project and where difficulty is experienced in setting up standards of evaluation. River Basin methods of cost allocation, as heretofore described, are used in this study for providing the means for this latter separation. Such jointly used facilities are illustrated by water rights, source of water supply lands, storage reservoirs, jointly used tunnels, and general capital. Under expenses, such items as hydrography, the maintenance of jointly used roads, are also examples.

It will be of interest to set down more fully the manner in which the plant facilities have been laid out for separation. These are:

For Water Supply:

Right of Way Lands (part)
Surface Drainage at Moccasin
All Classified Water Capital including pumping, purification, tunnels, pipe lines, certain roads and trails in the Foothill, Coast, San Joaquin, Coast Range and Bay Crossing Divisions.

For Power Supply:

Right of Way Lands (part)
Lower Cherry Division
Cherry Division
Lake Eleanor Division
Power Division Plant as classified on the books - except the re-regulating reservoir at Moccasin and certain General Plant.

For Joint Use:

Franchise and Water rights
Source of Water Supply Lands
General Office Lands
Roads and Trails (part)
Buildings - Source of Water Supply (part)
General Office
O'Shaughnessy Dam - both the initial construction and raising the height of the Dam

Early Intake Diversion
Mountain Tunnel
General Equipment and General Plant (part)

Cost Allocations - Operating Expenses:

Direct allocations, under part (1) as to Operating expenses, will first be presented. On the books there is no separate classification in expenses as between Power and Water. Accordingly, the first objective of this phase of the study is to separate the annual expenses of Operation into the three categories of Power, Water and Joint. As Appendix A-2 states, such a separation is predicated on an understanding of the nature of the expenditure, the function of the activity performed,

and the time spend as between the two divisions of Power and Water. Those expenses assigned to Joint will be allocated to each of the two principal functions under River Basin allocation procedure - part (2).

In the tabulation that follows, the annual expenses that are brought forward from Appendix A-2* are classified as between the three categories and are exclusive of the interest function. The amounts, by functions and the total, for the adjusted 1952-53 year are:

	Power	Water	Joint	Total
Production				
Purchase Power	$252,646	$ -	$ -	$252,646
Operation and Maintenance	254,808	53,235	143,102	440,145
Transmission				
Operation and Maintenance	213,539	57,298	28,694	299,531
Sub-total	720,993	110,533	160,796	992,322
Depreciation	250,216	1,042,375	417,748	1,710,339
Taxes	8,220	12,020	30,000	50,240
Distribution				
Operation	196	195	-	391
Wheeling Charge	949,977	-	-	949,977
Administrative and General	263,470	87,823	-	351,293
Commercial Expense	14,000	-	-	14,000
Project Annual Expenses	$2,207,072	$1,252,946	$608,544	$4,068,562
Percent	54.25	30.80	14.95	100.00

Due to the inherent nature of the operation of water storage reservoirs, tunnels and pipe lines, the operating and maintenance expenses are comparatively small for the Water function, as compared to the electric where, in addition, a power station and overhead lines are involved. The heavy charge for Water in expenses is the provision for depreciation on the large capital investment.

In the Power Division, the costs for supplemental power purchases and the wheeling charge for the movement of the electrical

* Principal tables are incorporated in the Appendix attached to the report.

energy from Newark over foreign facilities, which also includes transformation, regulation, distribution and metering is in lieu of an added investment and direct operating expenses of the Power Division.

Administration and General expenses have been allocated 75 per cent to Power and 25 per cent to Water. On a direct operating and maintenance expense basis, the assignment would have been 81 per cent. If treated as a Joint expense under the River Basin separation, 80 per cent would have resulted. Giving greater weight to the functions performed, also some consideration to the large capital investment in Water supply, a 25 per cent assignment to that Division appeared to be justified.*

The Joint expenses of $608,544 will be allocated as between the Power and Water Divisions on the River Basin method in a subsequent section.

Plant Investment - Direct Allocations:

From Appendix A-3, fixed capital, by accounts is set up and assigned to the three categories of Power, Water and Joint. In these Tables there is also developed the Reserve for Depreciation and the annual decpreciation expense (the latter as used under expenses as heretofore presented).

As a result of this study, both capital and depreciation are set up and classified as between Water and Power. Inasmuch as all

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* The relationship between the direct operating and maintenance expenses (per Appendix A-3a) charged to Power and Water, exclusive of cost of power and the Wheeling Charge, is 80.9%.

On a Capital basis (per Appendix A-3a) the relationship between Power and Water is 17.1% and 82.9%, respectively.

On the basis of adjusted revenue, the relationship as between Power and Water is 53.3% and 46.7%, respectively.

impounding dams and canals and conduits - including tunnels - are classified in the books of accounts as part of the Water Supply Division, an analysis has been made as to the use made of all plant facilities. Appendix A-3 sets forth the results and the considerations which lead to the separation as between the three classifications - irrespective of the manner recorded on the books. The resulting average plant capital, depreciation reserve, and net plant for the fiscal year ending June 30, 1953, are as follows:

Division	Total	Power	Water	Joint
	(Per Books)	(Allocation Per Study)		
Average Plant Capital				
Water Supply	$104,743,150	$ 2,299,292	$66,709,648	$35,734,210
Power Supply	13,134,498	11,559,278	417,543	1,157,677
Total	$117,877,648	$13,858,570	$67,127,191	$36,891,887
Average Reserve for Depreciation				
Water Supply	$ 22,497,828	$ 824,365	$15,274,061	$ 6,399,402
Power Supply	6,983,148	6,275,300	157,734	550,114
Total	$ 29,480,976	$ 7,099,665	$15,431,795	$ 6,949,516
Per cent of Plant Capital	25.0%	51.2%	23.0%	18.8%
Average Net Plant Investment				
Water Supply	$ 82,245,322	$ 1,474,927	$51,435,587	$29,334,808
Power Supply	6,151,350	5,283,978	259,809	607,563
Total	$ 88,396,672	$ 6,758,905	$51,695,396	$29,942,371

The interest component or burden at the 4 per cent rate on the net plant investment, plus the other project annual expenses, as heretofore developed by functions, are:

	Power	Water	Subtotal	Joint	Total
Interest at 4%	$ 270,356	$2,067,816	$2,338,172	$1,197,695	$3,535,867
Project Expenses	2,207,072	1,252,946	3,460,018	608,544	4,068,562
Total Costs	$2,477,428	$3,320,762	$5,798,190	$1,806,239	$7,604,429

Directing attention first to the plant capital and reserve tabulations, the amounts under the headings of Power, Water and Joint represent the initial separation of the recorded plant capital for each

of the three categories.

Under the cost approach as a basis for the level of rates charged for Power and Water service, earnings are only permitted on the Net Plant Investment. Thus the size of the reserve for depreciation is important. Likewise, the rate at which depreciation is accrued affects the annual expenses. The objective necessarily is to accrue depreciation at the proper rate.*

The impact of the large investment in the Water Supply Division is seen through the interest charge. It is also noted that a large plant capital has been placed in the Joint function to be allocated as between Water and Power. Before proceeding with the latter, it may be noted that this initial separation has been based upon an intimate examination and analysis of the use made and the functions performed for each phase of the Project involved.

<u>Joint Costs Allocation or Separation</u>:

Based upon the River Basin method, it is the conclusion that approximately 80 per cent of the Joint capital facilities and annual costs of operation are to be borne by the Power Function, and that 20 per cent is to be borne by the Water function. The analysis made shows that the Water function, at this stage of the project development, is clearly the marginal service. In utilizing the River Basin approach - wherein no function of a multiple-purpose project may be assigned costs greater than the cost-benefits of that function, the allocation developed is viewed as

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* The reserve for depreciation in the Power Division is 51.2% as developed in this Study. Having in mind the apparent future expectancy of the facilities, the present reserve appears high.

meeting the basic premises of that philosophy and such allocation appears reasonable.

In the tabulation that follows, the basic elements utilized in the development of the 80 - 20 relationship are set forth.

River Basin Allocation of Joint Costs: (Annual)

Item	Power	Water	Total
	(Thousands of Dollars)		
1 - Benefits - Gross	4600	3850	8450
2 - Alternate Costs	4640	4426	9066
3 - Benefits Limited by lesser of Items 1 and 2	4600	3850	8450
4 - Specific (Separable) Costs	2477	3321	5798
5 - Remaining Benefits (Item 3 - 4)	2123	529	2652
6 - Per cent-Relationship (Item 5)	80.1%	19.9%	100.0%
7 - Percentages used	80%	20%	100%
8 - Allocation of Joint Costs	1445	361	1806
9 - Add Specific Costs (Item 4)	2477	3321	5798
10- Total Annual Costs (Items 8 plus 9)	3922	3682	7604

Discussion:

Each of the elements entering into the allocation will now be briefly discussed.

Benefits - Gross:

Power Supply Benefit:

The 4,600,000 dollars for Power is intended to represent the gross primary power benefit to the users of project power service. It has been measured by the approximate cost to the users of the City's service of an alternate power delivery that would most probably be utilized in the absence of Hetch Hetchy service. In the instant case, the alternate service assumed is that from Pacific Gas and Electric Company, except for the service supplied to the Irrigation Districts. In order to utilize the most conservative approach for the latter, it has been

assumed that the District's wholesale purchases would be made from the Bureau of Reclamation.*

Appendix A-4 shows the increases in present revenue by the different classes of service that are estimated to take place, as well as the basis of the estimates.

The over-all figures are as follows:

Present project revenue - adjusted basis	$4,043,626
Estimated increase on alternate supply - 13.8%	556,474**
Total	$4,600,100

Water Supply Benefit:

The Water Supply benefit of $3,850,000 is viewed as a much less definitive estimate. To say what an alternate water supply for a large metropolitan area such as San Francisco, of the same quality and water availability, would cost is viewed as quite speculative.

For purpose of this study, costs and/or charges made for other projects have, in part, been reviewed - particularly those of the East Bay Municipal Utility District and of the Metropolitan Water District of

* The rate used is predicated on that charged the Sacramento Municipal Utilities District. If resale schedule "R" of Pacific Gas and Electric Company were used, the annual billing would be approximately 450,000 dollars higher. If a 10 per cent discount be assumed, that billing would be more than 340,000 dollars higher than from the Bureau. Studies show that the "R" rate is below Pacific Gas and Electric's cost to serve. No consideration has been given to possible additional costs arising from the necessity to build connecting facilities by the Irrigation District to secure the Bureau's delivery, nor whether power deliveries would be available to the District from the Bureau.

** From Appendix A-4, the $556,481 is brought forward and rounded off to $556,474, so an even total of $4,600,100 results as per above tabulation.

Southern California - and, of course, the costs of Hetch Hetchy Project itself.

The revenue per acre foot realized from the Hetch Hetchy Water sales for the last four years is as follows:

Sales And Water Revenue

Period	Hetch Hetchy Water Revenues	Recorded Deliveries (Acre feet)	Revenue Per Acre Foot
1951 - 52	$3,445,250	68,527*	$50.27
1952 - 53	3,545,590	68,765*	51.56
1953 - 54	3,545,590	101,556	34.91
1954 - 55	4,030,000	118,000 Est'd	34.15

These amounts, on an acre foot basis, are higher than the cost analysis of the East Bay Municipal District showed. They are generally higher than other comparable water costs acquainted with.** However, no two costs are necessarily entirely comparable. An adequate, acceptable, and economically feasible water supply is not something that a plant can be built to produce - as is the case of providing an alternate electric

* Water deliveries are viewed as low. Yearly deliveries may vary sharply from "normal" due to the character of the water year and the production from Non-Hetch Hetchy sources, as well as because of work being done on pipe lines and tunnels. Large terminal storage permits relatively large annual variations. The system now has an approximate peak day through capability of 160 million gallons. With an annual delivery of 100,000 acre feet, or 32,585 million gallons, the annual load factor would be but 55.8 per cent. At such a delivery, for the fiscal year 1952-53, all water releases to the Irrigation Districts could easily have been met and the drop in terminal storage which took place would have been lessened.

** Some wholesale delivery costs in the San Diego area are substantially higher.

supply.

It is the view that, for the period of the study, an equivalent water delivery of 100,000 acre feet would be reasonable and, at a cost of $38.50 per acre foot, there would result a gross revenue benefit of $3,850,000 for the Water Supply.

Alternate Cost For Power Delivery:

Under Item 2, Alternate Costs, the amounts shown represent the estimated annual costs of the operation of alternate projects built in the same time period as the Moccasin Power Plant (1924-25), but operated at the level of the 1952-53 costs.

Appendix A-5 shows the estimate of the costs of a Steam Electric generating plant*, built in the vicinity of Newark, with the capacity of Hetch Hetchy's own power system. In order to minimize changes in existing system layout, plant facilities, and capability, the same wheeling arrangement for the movement of the energy from Newark to load centers is maintained. As the Table referred to shows, the estimate provides for an investment cost of $100 per Kw for the main station and with the sub-transmission and step-up substation, a total cost of $113.75 per Kw - or a total investment of $9,100,000 for a station capacity of 80,000 Kw. A net efficiency of 465 kilowatt hours per barrel of fuel oil, with oil at $1.90 per barrel, has been used.

The total annual costs developed for 517,000,000 kilowatt hours delivery at Newark are:

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* It has been assumed that a steam plant at Newark could be operated at less cost than a single purpose hydro plant on the Hetch Hetchy system.

Total annual costs for plant	$3,160,000
Purchase of supplemental kilowatt hours (present)	253,000
Wheeling, rental, General & billing expense (present)	1,227,000
Total indicated annual costs from alternate power source	$4,640,000

This alternate steam plant annual cost of $4,640,000 compares with $4,600,000 - termed the Gross Benefit which represents the indicated cost of the present power service, supplied from the most likely present available source, now supplied by the Hetch Hetchy Project for $4,044,000.* The most likely present available alternate source is Pacific Gas and Electric for all service except that sold to the Irrigation Districts and, for the latter, the purchases are assumed to be made from the Bureau of Reclamation.

Alternate Cost for Water Delivery:

The alternate cost for the Water delivery is based on a single purpose water development wherein the present system is utilized, except for:

1 - The investment and associated cost due to raising of O'Shaughnessy Dam, which is omitted.

2 - The 18.8 miles of Mountain tunnel has been considered replaced by a 6.4 mile tunnel of the same size and gradient that extends in a straight line from a new diversion dam to the intake of the Foothill tunnel.

3 - A diversion dam on the Tuolumne River, 500 feet above the mouth of the North Fork of the same River is built. The crest is at elevation 963 - the present

* Per Appendix A-4.

water surface of the River is at elevation 850. The water surface of the pool above the dam is at elevation 953 - giving a free board of 10 feet. The invert at the intake to the existing Foothill tunnel, where delivery would be made, is at elevation 881 feet. Appendix A-6, gives further information and a summary of the investment and annual costs involved.

From Appendix A-6, the investment developed is 89,146,000 dollars, and an annual cost of 4,426,000 dollars results for the operation of this single-purpose project. This is at the rate of over 44 dollars an acre foot for the test year, and is higher than the estimated benefits of 38.50 dollars per acre foot, or a total of 3,850,000 dollars - and hence drops out - as the costs cannot exceed the benefits derived.

Before passing to the next subject in the Cost Allocation development, this alternate single-purpose water development is not represented as being the cheapest one that could be developed. It is viewed as only one of several. A lower cost single purpose project could possibly be developed. However, if the water were carried in the open river channel further down stream without the benefit of the protection of higher cost tunnel waterways, problems of contamination and water right control would arise, which is viewed as beyond the scope of this study.

It would be expected that, if the multiple-purpose project were economically feasible, its combined cost would be lower than the sum of the separately constructed individual projects. The costs so work out. As has been previously stated in the case of the Power

function, the alternate cost of steam plant delivery is but slightly higher than the estimated level of revenue that could be charged. However, since the alternate steam plant costs are higher, such costs are not controlling and, therefore, the costs of securing the same service from an existing alternate service (Pacific Gas and Electric Company) are used as a measure of the Gross Power Benefits under Item 3 in the River Basin allocation of Joint Costs, on the previous page.

Specific Project Costs:

Item 4, "Specific Project Costs" represents those annual costs that have been identified as applicable to each of the Power and Water functions, and are exclusive of the costs that are common to both - i.e., the Joint Costs.

Specific Project Costs have previously been summarized and include the interest component at 4% on the net capital investment, and all other expenses of operation. The totals developed are:

	Power	Water	Total
Specific Costs	\$2,477,428	\$3,320,762	\$5,798,190

These amounts, rounded off to the nearest thousand, have been carried forward as Item 4 in the tabulation of River Basin Allocation of Joint Costs.

Remaining Benefits and Allocation Percentages:

As the title, Item 5 indicates, it is the difference between the Gross Benefits, Item 3, and the Specific Costs, Item 4, which results in the remaining and/or net benefits.

It is this relationship between the remaining benefits of the two functions from which the allocation percentages are derived.

The percentages developed are:

80% of the Joint Costs to the Power Function; and

20% of the Joint Costs to the Water Function.

Allocation Of Joint Costs:

The Joint Project Costs that have been developed and that are deemed common to both Power and Water are:

	Joint Costs
Project Expenses (Appendix A-2a)	$ 608,544
Interest at 4% on $29,942,371*	1,197,695
Total	$1,806,239

Under Item 8, the Joint Costs are separated by an allocation of 80 per cent to Power and 20 per cent to the Water function.

Total Annual Costs:

The Joint Costs under Item 8 are added to the Specific Costs (Items 4 and 9) from which the total Annual Costs for each of the two Divisions are developed. These are:

	Power	Water	Total
	(Thousands of Dollars)		
Total Indicated Annual Costs with interest at 4%	3922	3682	7604

In the next Chapter on Earning Position, costs do not include a 4 per cent interest rate - rather, the actual rate of return is first developed under present revenues and subsequently total costs are set up which include selected rates of return. In all instances, however,

* Appendix A-3a

Average Plant Capital - Joint	$36,891,887
Average Depreciation Reserve - Joint	(6,949,516)
Average Net Jointly used Capital	$29,942,371

all costs assigned to the Power Division carry an 80 per cent allocation of both the plant capital and expenses for the Joint cost component.

The next Chapter on Earnings will further demonstrate the justification of the River Basin allocation fundamental that cost assignments cannot exceed the cost benefits - if a project is to survive from an economic standpoint.

CHAPTER III

EARNING POSITION OF HETCH HETCHY POWER AND WATER PROJECT

CHAPTER III

EARNING POSITION OF HETCH HETCHY POWER AND WATER DIVISIONS

In this Chapter, the financial results of operation are developed.

The revenues, expenses of operation, and capital amounts are brought forward. These may be set down as follows, for the adjusted 1952-53 year:

Rate of Earnings under Present Charges for Service:

Items	Reference Appendix	Power	Water	Total
Gross Revenues:*				
S. F. Municipal	A-4	$2,169,717	$	$
Irrigation Districts	A-4	559,628		
Commercial Loads				
Riverbank & Permanente Cement	A-4	1,244,203		
Other Revenues from kilowatt hour sales-including Kaiser Aluminum	A-4	70,078**		
Wholesale Water Revenue			3,545,675***	
Total Revenues		4,043,626	3,545,675	7,589,301
Less Other Revenues - credited to expenses	A-4	70,078		70,078
Net Revenues from Sale of Energy		3,973,548	3,545,675	7,519,223

* The Hetch Hetchy Project had, in addition, non-operating revenues in the amount of $62,599 during the fiscal year ending June 30, 1953 - resulting in a total return of 4.04%.

** As shown in Appendix A-4, the $70,078 is an adjusted revenue for the services rendered Kaiser Aluminum, for the limited sales made in Tuolumne County, and for any revenue received from dump deliveries made by Hetch Hetchy to Pacific Gas and Electric.

As initially stated in Chapter I, Kaiser Aluminum is an assigned load from Pacific Gas and Electric. The service is subject to curtailment under certain conditions and, because of this fact, the rate charge is lower than for other power loads that are serviced on a "firm" basis.

In the Cost Study, as shown in the above tabulation, system revenues have been reduced by the $70,078 received from these services, and expenses credited with a like amount. By this treatment, the assumption is made that revenues and costs are offsetting.

In Chapter IV, full cost assignments are made to the Kaiser Aluminum load to test whether revenues are sufficient to cover costs of providing the service. The analysis shows that it is.

*** Per Income Statement for the fiscal year ending June 30, 1953.

Items	Reference Appendix	Power	Water	Total
Revenue Deductions:				
Production	B-1	$ 613,136	$ 79,655	$ 692,791
Transmission	B-1	236,494	63,037	299,531
Distribution	B-1	950,173	195	950,368
Commercial	B-1	14,000	-	14,000
Administrative	B-1			
& General	B-1	263,470	87,823	351,293
Depreciation	B-1	584,414	1,125,925	1,710,339
Taxes & Fees	B-1	32,220	18,020	50,240
Total Revenue Deduction	B-1	2,693,907	1,374,655	4,068,562
Credit - Other Revenue deductions	A-4	70,078		70,078
Net Revenue Deductions		2,623,829	1,374,655	3,998,484
Net Revenue (Gross less Deductions)		1,349,719	2,171,020	3,520,739
Rate Base	B-2	31,033,000	57,760,000	88,793,000
Rate of Return		4.35%	3.76%	3.97%

Any examination of the costs will show that the Water Supply function has relatively small direct operating costs but, due to the large capital investment in water conduits and reservoirs, the depreciation and interest components increase these very materially - which, in turn, calls for a much larger net revenue than the Power function in order to service the debt. Due to this fact, under the net benefit theory of River Basin allocations, a major portion of the Jointly Used facilities is allocated to the Power function. Under the straight line method of depreciation accounting, as more of the plant capital is written off, the earning position of the Water function will improve faster than the Power and eventually the carrying charges on the net capital invested in the Water function will become very small. However, such a period is a long way in the future and is dependent upon rate of growth of plant additions.*

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* This reduction in net plant capital will be off-set, in part, by new plant additions as water facilities are enlarged to increase the

Net and Gross Revenue Requirements under Higher Returns:

One ceiling as to a practical upper limit on earnings for the Power Division would be that resulting from revenues received at competitive rate levels.* Using this standard as developed in Appendix A-4, a gross revenue of $4,600,000 could be expected which would yield a return of 6.14%.** This would call for an increase in customer rates of approximately $556,500 annually, or 14.0%.

Any number of combinations of customer rates could be established that would yield rates of return ranging from the present 4.35% to the ceiling return of 6.14% for the Power Division.

The following tabulations show the net revenues for both Power

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(Continued from previous page):
delivery capability of the Hetch Hetchy Water System. Inasmuch as the Power function will likewise be expanded, the over-all impact cannot be stated at this time. However, the basic principle is believed as stated. Consideration may also be given to a lesser rate of write-off through a decrease in the depreciation accrual rates, as many plant facilities will be fully depreciated in a relatively few years, yet their service life will extend far into the future.

* The $556,500 annual system increase in revenues, from Alternative Sources of delivery includes the very low revenue power from the Bureau of Reclamation for service to the Irrigation Districts. As shown in Chapters IV and V that follow, such assumed source of purchase will yield a revenue lower than the indicated costs of delivering Hetch Hetchy energy to the Districts. Revenues for deliveries under the Raker Act (Section 9 (i)) are interpreted as being based upon costs. In other words, a statutory requirement must necessarily be given consideration in fixing the price at which electric energy is sold to the Districts.

**	Gross revenue - present rates	$4,043,626
	Increase to bring to competitive level	556,474
	Gross revenue under competitive rates	$4,600,100
	Less revenue credit	70,078
	Gross revenue - net	$4,530,022
	Less revenue deductions	2,623,829
	Net revenue for return	$1,906,193
	Rate Base	$31,033,000
	Rate of Return	6.14%

and Water at selected rates of return falling within this range. Increases in gross revenues are also presented:

	Power	Water	Total
	$	$	$
Net Revenue Realized	1,349,719	2,171,020	3,520,739
Net Revenue at 4.5%	1,396,480	2,599,200	3,995,680
5.0%	1,551,650	2,888,000	4,439,650
5.5%	1,706,810	3,176,800	4,883,610
5.7%	1,768,880	3,292,300	5,061,180
6.0%	1,861,980	3,465,600	5,327,580
6.14%	1,906,193	-	-

Increases in Gross Revenue	Amount	%	Amount	%	Total	%
to yield 4.5%	46,760	1.2	428,180	12.1	474,940	6.3
5.0%	201,930	5.1	716,980	20.2	918,910	12.2
5.5%	357,090	9.0	1,005,780	28.4	1,362,870	18.1
5.7%	419,160	10.5	1,121,280	31.6	1,540,440	20.5
6.0%	512,260	12.9	1,294,580	36.5	1,806,840	24.0
6.14%	556,470	14.0	-		-	

Due to the much larger capital base for the Water Supply Division, the dollar increase for that Division is substantially greater than for the Power for a specified higher rate of return. Likewise, the percentage increases in relation to gross revenue are substantially higher. Normally, the furnishing of a water supply to a metropolitan area would be viewed as a more stable function than a similar marketing of power supply. Hence, a higher rate of return would probably be accorded the power function to compensate for the greater financial risk involved. For this reason, a return greater than 6.0% is not included for the Water Supply Division.

Interest and Bond Redemption Requirements:

From the net revenue earned, the bond interest must first be met. The balance of the net earnings become a part of earned surplus from which capital additions could be made but, more than likely, the balance will be used, in part, to pay for the redemption of outstanding bond issues.

A schedule of bond interest and redemption requirements is maintained by the Department. Even though costs, as developed in this Study, are exclusive of an allowance for bond redemption, nevertheless the dollars required to meet this obligation arise from the Power and Water Division operations. These requirements are not separated as between Water and Power. The amounts in question for a three-year period are:

Year	Interest	Redemption	Total
1952-53	$1,787,239	$3,469,000	$5,256,239
1953-54	1,706,321	3,544,000	5,250,321
1954-55	1,572,251	4,102,000	5,674,251

The interest requirement for 1952-53 is $1,787,239 (exclusive of that charged to construction and capitalized) and compares with a net indicated revenue from earnings of $3,520,739. This leaves a balance of $1,733,550 which could be applied to the bond redemption of $3,469,000. Thus, half the monies to care for the bond retirement must come from other sources. In this case, it would appear that the only other source would be the utilization of depreciation accrual monies (i.e., the amount of depreciation accruals in excess of the current retirements*).

This is common practice in municipal operations, but it necessarily means that future bond issues will be required to repay the depreciation monies so used when, in the future, large plant replacements

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* If the Power and Water portions be separated out on the respective relationships of the total plant investments - 36.8% would go to Power, and the balance to Water - Thus:

(Year 1952-53)	Power	Water	Total
Interest	$ 657,525	$1,129,714	$1,787,239
Redemption	1,276,245	2,192,755	3,469,000
Total	1,933,770	3,322,469	5,256,239
Present Net Revenue	1,349,719	2,171,020	3,520,739
Deficiency	584,051	1,151,449	1,735,500

become necessary, unless earnings have grown sufficiently to accomplish the same purpose.

Summary:

In summation, this Chapter has developed for the Project as a whole:

1 - the rate of earnings under present rates and revenue;

2 - the magnitude of the possible rate increase to yield a stated rate of return with the revenue involved; and

3 - the over-all financial requirements of both the Power and Water Divisions.

This completes this part of the study.

The next phase of the study is limited to the Power Function. It will be the purpose of this last part of the Study, made up of two Chapters, to break down the total costs of operation as between the different classes of service, and lastly to determine what system of rates and charges will be required to produce the over-all revenue requirements deemed appropriate.

CHAPTER IV

COST ALLOCATIONS TO CLASSES OF POWER SERVICE

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COST ALLOCATIONS TO CLASSES OF POWER SERVICE

In this Chapter, annual costs as developed for the Power Division as a whole (Chapters II and III), are further analyzed and are allocated to the many different classes and customer groups that are supplied with electric service by the Hetch Hetchy Power System. In many respects, this phase of the work may be considered the heart of the analysis and one of primary importance, as it reveals indicated costs of providing the electric service to each of the customer groups. These developed costs thus become available and provide one of the important standards or guides that may be used as one basis in fixing the level of customer rates.

Need of Cost Allocations:

Hetch Hetchy production, transmission, and distribution facilities are not dedicated to any one customer or individual group of customers, but are used jointly in varying degree by all. For this reason, it becomes necessary, in a study of this nature, to allocate the cost of such services between customers or groups of customers in accordance with the use made by each of these groups.

Basis of Cost Allocations:

Capital and annual costs are first broken down into three components, namely:

1 - Demand

2 - Commodity

3 - Customer

Briefly, it may be said that the objective is to assign:

To Demand - those costs that are influenced by the rate of customer use;

To Commodity - those costs that are influenced by the volume of customer use; and

To Customer - those costs that are influenced by the number of customers, their location, and the minimum size of service.

Cost Allocation Theories:

It is the intention to assign costs to the different classes essentially on the basis of class use as represented by demands imposed and kilowatt hours consumed.

Generally, customers and customer groups impose varying degrees of demand, which are expressed in kilowatts, and likewise varying degrees of hours of use - expressed in kilowatt hours. The expression of average use as a percentage of maximum use is commonly spoken of as the load factor. The use of the load factor may become a helpful tool in cost allocations procedures. It is so viewed and used in this Study.

For the adjusted year, the system demand is approximately 69 per cent of the maximum coincidental system demand - i.e., the load factor is 69 per cent. For each kilowatt of system capacity, 69 per cent, on the average, is utilized in the generation, transmission and distribution of kilowatt hours; while the remaining 31 per cent of the system capacity is employed in meeting system demands above the average.

In the allocation of the system demand and commodity charges as between the different classes of service, the load factor method is

further brought into use in that (1) the commodity costs are allocated on the basis of kilowatt hours, or average demand; and (2) the demand charges are assigned on the basis of demands in excess of the average. Other methods of demand allocation have also been explored for some of the more important non-municipal loads.

The Customer Cost allocation, in a system of this nature, must primarily account for the investment and annual costs associated with the service and metering facilities for those customers served directly from transmission. For other customers, a similar treatment has been accorded after taking into consideration the distribution facilities involved. It may be well also to observe that, where the number of customers are relatively few, and where the use per customer (per meter) is high, such as in the railway service or resale to the Irrigation Districts, the customer component, while larger in amount than for a Lighting customer, yet this dollar amount is exceedingly small in relation to the other costs of Demand and Commodity and, hence, becomes quite a secondary factor in the over-all cost assignment.

Special Features:

As a result of the Raker Act and the various Commercial Agreements to which the City is a party, certain priorities must be observed, namely:

A - Priorities as to use of power deliveries from the Hetch Hetchy Project. The order of priority is:

1 - Municipal Loads of City and County of San Francisco

2 - Modesto and Turlock Irrigation Municipal Loads

3 - Permanente Cement Company

4 - Kaiser Aluminum

5 - Riverbank Ordnance Plant

B - Priorities as to Supplemental Power Purchases

Supplemental power purchases from Pacific Gas and Electric by the City to make up for deficiencies in Hetch Hetchy deliveries to supply the power requirements of Customers served by the City are required to be assigned and charged for in the reversed order of priority in reference to Hetch Hetchy deliveries - namely, in this order:

1 - Riverbank Ordnance Plant

2 - Kaiser Aluminum

3 - Permanente Cement

4 - Modesto and Turlock Irrigation Districts

5 - Municipal Loads of City and County of San Francisco

In the cost allocation analysis, the priority requirements noted have required that the Project's own deliveries be identified and kept separate both as to kilowatt hours and costs, and that Supplemental Purchases be assigned to the Customers responsible for such purchases.

C - Priority Status of Kaiser Aluminum as an Interruptible Load:

In this study, service to Kaiser Aluminum is treated as subject to interruption, as provided under the contract with Pacific Gas and Electric Company*. Because of this condition, it has been accorded

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*This is one of three customers assigned by Pacific Gas and Electric Company to the City and County of San Francisco under the main contract for the disposal of Hetch Hetchy energy, dated March 14, 1945. The Contracts between Kaiser Aluminum and Pacific Gas and Electric Company are under dates of July 2, 1941 and April 28, 1952.

Such customer assignments provide a direct sales market for the City for such Hetch Hetchy power as may be available and conforms to the interpretation placed on the Raker Act for the disposal of electric energy developed in the Hetch Hetchy System. Because of seasonal and yearly variations in the amount of Hetch Hetchy power, and because of

different treatment. In the study proper, Kaiser Aluminum revenues have been considered as a credit to the costs of project operation. As previously mentioned, because the sales to this load dropped from nearly 140 million kilowatt hours and a revenue of over $716,000 in the study year, to less than 8 million kilowatt hours and to a little over $52,000 in the subsequent year, the latter year figures have been used in the Adjusted Year, with corresponding downward adjustments in the purchase of supplemental energy.

System Allocation - Power Division:

In Table 1, total annual costs of operation are allocated between the three cost components.

Expenses are taken from Appendix B-1, and to these are added the net revenues to yield a return* of 4.35% and 5.7%, respectively. The

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(continued from previous page):
growth of customer loads, of prior rights of other customers to Hetch Hetchy power, there is an insufficient City-developed power, and the deficiencies in power requirements are purchased from Pacific Gas and Electric Company.

In effect, this arrangement with the Private Utility makes possible the complete utilizations of all Hetch Hetchy energy that is developed and provides a market for the disposal of that energy to the City's own customers.

* The return of 4.35% is that computed for the Power Division under present costs and charges for electric service (Chapter III).

  The return of 5.70% is selected as representing a conservative level for a rate of earnings. For large electric systems in California that are under State regulations, rates of return allowed in recent years range from approximately 5.6% to 5.9% (Pacific Gas and Electric Company - Decision No. 47832; Southern California Edison - Decision No. 50449; and San Diego Gas and Electric Company - Decision No. 51687. These utilities are not only much larger than the Hetch Hetchy electric system, but their loads are viewed as much more diversified and stable and hence the Hetch Hetchy system might be viewed as justifying an earning level somewhat higher though this in turn would inpart be offset by the lower cost of money enjoyed by the City system. Municipalities and other

SYSTEM ANNUAL COST ALLOCATIONS
ADJUSTED YEAR 1952-53
HETCH HETCHY POWER DIVISION

Table 1
Sheet 1 of 2

Line No.	Item	Total System Costs (a)	Demand Amount (b)	Demand % (c)	Commodity Amount (d)	Commodity % (e)	Customer Amount (f)	Customer % (g)
1.	I Power Pool Production							
2.	Purchase Power (Basic)	$ 60,000	$ 60,000	100	$ -	-	$ -	-
3.	Purchase Power (Suppl.)	192,646	1,949	1	14,524	8	176,173*	91
4.	Operation	213,260	66,111	31	147,149	69	-	-
5.	Maintenance	147,230	45,641	31	101,589	69	-	-
6.	Subtotal	613,136	173,701	28	263,262	43	176,173	29
7.	Transmission							
8.	Operation	45,798	13,875	30	30,884	68	1,039	2
9.	Maintenance	136,696	41,732	30	92,886	68	2,078	2
10.	Rents	54,000	-	-	-	-	54,000	100
11.	Subtotal	236,494	55,607	23	123,770	53	57,117	24
12.	Customer Accounting	3,200	-	-	-	-	3,200	100
13.	Depreciation	584,414	179,880	31	400,377	68	4,157	1
14.	Taxes - Local	8,220	2,548	31	5,672	69	-	-
15.	Federal	24,000	7,440	31	16,560	69	-	-
16.	Administrative & General	197,600	61,256	31	136,344	69	-	-
17.	Credit & Miscellaneous Revenues	(70,078)	(20,901)	30	(46,520)	66	(2,657)	4
18.	Subtotal	1,596,986	459,531	29	899,465	56	237,990	15
19.	Return at 4.35%	1,349,915	417,072	31	928,322	69	4,521	-
20.	at 5.7%	1,768,880	546,516	31	1,216,440	69	5,924	-
	Total Pr. Pool							
21.	with 4.35%	2,946,901	876,603	30	1,827,787	62	242,511	8
22.	with 5.7%	3,365,866	1,006,047	30	2,115,905	63	243,914	7
23.	II Distribution Pool							
24.	Customer Accounting	10,800	-	-	-	-	10,800	100
25.	Administrative & General	65,870	-	-	-	-	65,870	100
26.	Subtotal	76,670	-	-	-	-	76,670	100
27.	Wheeling Charges	949,977	285,190	30	634,777	67	30,010	3
28.	Total Dist. Pool	$1,026,647	$ 285,190	28	$ 634,777	62	$106,680	10

SYSTEM ANNUAL COST ALLOCATIONS
ADJUSTED YEAR 1952-53
HETCH HETCHY POWER DIVISION

Line No.	Item	Total System Costs (a)	Demand Amount (b)	Demand % (c)	Commodity Amount (d)	Commodity % (e)	Customer Amount (f)	Customer % (g)
29.	III Total Costs							
30.	Exclusive of Return	$2,623,633	$ 744,721	28	$1,534,242	59	$344,670	13
31.	With Return of 4.35	3,973,548	1,161,793	29	2,462,564	62	349,191	9
32.	With Return of 5.70	4,392,513	1,291,237	29	2,750,682	63	350,594	8

* Under the terms of the Raker Act, San Francisco Municipal and the Irrigation Districts loads have priority for the Hetch Hetchy's own deliveries. Supplemental power purchase costs exclusive of the annual minimum of $60,000 and purchases for Kaiser Aluminum, are placed in the customer column for later assignment to Permanente Cement and Riverbank Ordnance.

latter are computed on the Rate Base amounts set forth in Appendix B-2. Net revenue figures are also developed in the text under Chapter III-Earning Position. The costs developed are:

	Total	Demand		Commodity		Customer	
	Amount	Amount	%	Amount	%	Amount	%
Power Pool:*							
Exclusive of Return	$1,596,986	$ 459,531	29	$ 899,465	56	$237,990	15
With 4.35% Return	2,946,901	876,603	62	1,827,787	62	242,511	8
With 5.70% Return	3,365,866	1,006,047	63	2,115,905	63	243,914	7
Distribution Pool:*							
Wheeling Charges	$ 949,977	$ 285,190	30	$ 634,777	67	$ 30,010	3
Other	76,670	-		-		76,670	10
Total Distribution	$1,026,647	$ 285,190	28	$ 634,777	62	$106,680	10
Total Costs Exclusive Of Return:	$2,623,633	$ 744,721	28	$1,534,242	59	$344,670	13
With 4.35% Return	3,973,548	1,161,793	29	2,462,564	62	349,191	9
With 5.70% Return	4,392,513	1,291,237	29	2,750,682	63	350,594	8

It is observed there is no return component for the Distribution Pool set out. Such, however, is part of the Wheeling Charges, as all plant capital facilities are owned by the Private Utility.

(continued from previous page):
Governmentals that operate their own distribution systems commonly maintain a level of electric rate charges that yield very attractive returns.

* Power Pool is a term used to include Production and Transmission Costs, while other costs are brought together under the term Distribution Pool.

Supplemental Power Purchase Costs are placed in the Customer column, except for a base annual minimum charge of $60,000, which is assigned to Demand and the payment for Supplemental Power purchases for the Kaiser Aluminum load - adjusted year basis (actual 1953-54). Such costs are so treated as the revenue from the Kaiser Aluminum load is taken as a credit to operating expenses. A total of such operating expense credits (Line 17, Table 1) amounted to $70,078*. The Supplemental power costs assigned to Customer are all later charged directly to Permanente Cement and Riverbank Ordnance - the two customers making necessary that part of the purchase (Table 6).

The item of Rents under Transmission (Table 1), represents the rental paid on 110 and 60 Kv transmission lines owned by Pacific Gas and Electric Company that serve Kaiser Aluminum and Permanente Cement. The rental is placed in the Customer column and charged to the two customers named.**

Administrative and General expenses have been assigned 75% to

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* "Other Loads" (See Appendix A-4), composed of the small sales in Tuolumne County - mostly to the City's Summer Camp at Mather, and Dump Sales to Pacific Gas and Electric Company (there was none during the recorded year 1952-53 but on the adjusted year basis, a small amount is developed). The amounts are:

	Kwhr Sales	Revenue
In Tuolumne County	519,416	$ 5,343
Kaiser Aluminum	7,704,000	52,441
Dump Sales to P. G. & E.	4,239,212	12,294
Total	12,462,628	$70,078

** The first section (including the 110 Kv line) carries a monthly charge of $2,833.33 and has been assigned to the two customers on the basis of use. The second section (60 Kv line) only serves the Cement Company and carries a monthly rental of $1,666.66. Charges are per agreement of lease under date of April 18, 1945 with Pacific Gas and Electric Company.

Power Pool and 25% to Distribution, based upon the commonly used relationship of operation and maintenance expenses - including 20% of the Wheeling Charges under the Distribution Pool.

Class Allocation Load Data:

Before proceeding to allocate the total annual costs assigned to the three cost components developed in Table 1, it is necessary to develop the basis for such allocations to each of the classes of service. This will now be undertaken.

Class Kilowatt Hours and Demands:

In Table 2 is summarized the basic load statistics for the adjusted year 1952-53 by classes of service. The figures presented represent the results of an extensive survey and are further supported by Tables in the Appendix*. The results set forth in this Table are viewed as important as they are used to make the cost assignments between the different classes of service.

Under column (a), "Total Requirements" are tabulated the kilowatt hours of equivalent system input to production deliveries to transmission - both from Project generation and Supplemental purchases from Pacific Gas and Electric - the latter shown separately. All load data accordingly have been adjusted for line losses from Moccasin to Newark and from Newark to Customer meter.

In column (d), the Non-Simultaneous kilowatts of maximum demand represent the peak demands of each of the classes in whatever month such demands may have occurred. It may here be pointed out there is no great

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* Please turn to Appendixes C-2 and C-3 for further detail as to development of both kilowatt hours and demands.

CLASS KILOWATT HOURS AND DEMANDS
ADJUSTED YEAR 1952-53
HETCH HETCHY POWER DIVISION

Table 2

	Kilowatt Hours — Total Requirements (a)	Per Cent Column (a) (b)	Average Demand Kw. (1)/8760 (c)	Non-Simultaneous Peak Demand Kw — At Prod. (d)	Per Cent (e)	Excess Kw (d) - (c) (f)	Demand Per Cent Column (f) (g)	Annual ** Load Factor (c) / (d) (h)
I San Francisco Municipal Load	(Appendix C-2)			(Appendix C-3a)				
1. Railway A.C.	57,469,455	11.10	6,560	15,371	11.77	8,811	12.32	42.68%
2. Railway D.C.	36,350,617	7.02	4,150	11,123	8.52	6,973	9.75	37.31
3. Subtotal Railway	93,820,072	18.12	10,710	26,494	20.29	15,784	22.07	
4. Street Lighting	39,567,366	7.64	4,517	10,099	7.73	5,582	7.81	44.73
5. Traffic Signals	2,235,567	.43	255	280	.21	25	.04	91.07
6. Subtotal St. Ltg. & Tr. Sig.	41,802,933	8.07	4,772	10,379	7.94	5,607	7.85	
7. Crystal Springs Pumps	16,412,786	3.17	1,874	2,325	1.78	451	.63	80.60
8. All other loads								
a. Airport	23,773,245	4.59	2,714	5,515	4.22	2,801	3.92	49.21
b. Balance	60,302,443	11.64	6,884	27,605	21.14	20,721	28.98	24.94
c. Subtotal	84,075,688	16.23	9,598	33,120	25.36	23,522	32.90	
9. Total S.F. Mun. Load	236,111,479	45.59	26,954	72,318	55.37	45,364	63.45	37.27
II Irrigation District Load								
1. Modesto Irrig. Dist.	139,822,459	27.00	15,961	34,114	26.11	18,153	25.39	46.79
III(a) Commercial Loads (Firm) - Hetch Hetchy Energy Portion								
1. Riverbank Ordnance Plant	5,629,728	1.09	643	4,850	3.71	4,207	5.88	13.26
2. Permanente Cement Plant	136,339,882	26.32	15,564	19,339	14.81	3,775	5.28	80.48
3. Total Commercial Loads (Firm)	141,969,610	27.41	16,207	24,189	18.52	7,982	11.16	
Total Classes I, II and III (a)	517,903,548	100.00	59,122	130,621	100.00	71,499	100.00	
III(b) Commercial Loads - Supplemental Energy from P.G.& E Co.								
1. Riverbank Ordnance Plant	9,846,381		1,124	4,308*		3,184		26.09
2. Permanente Cement Plant	14,464,091		1,651	8,132*		6,841		20.30
3. Total Supplemental for Firm Comml. Loads	24,310,472		2,775	12,440*		10,025		
III(c) Commercial Loads (Firm) - Total								
1. Riverbank Ordnance Plant	15,476,109		1,767	4,850		3,083		35.20
2. Permanente Cement Plant	150,803,973		17,215	19,339		2,124		89.02
3. Total Commercial Loads (Firm)	166,280,082		18,982	24,189		5,207		
IV Total Classes I, II and III)	542,214,020		61,897	130,621		68,724		
)	542,214,020		61,897	89,315***				69.3***

* During months of class peak demands all load is supplied by Hetch Hetchy System - Amount shown are maximum demands of P.G.& E. for supplemental power in other months.

** Load Factors for Combination of Classes is not given as the coincidental peak demands of each class combinations are not known.

*** The system annual load factor is 69.3%. This is computed as the percentage relationship between the average demand of 61,897 kw and the system maximum peak coincidental peak demand of 89,315 kw (See Appendix C-1). This is exclusive of the Kaiser Aluminum load on the adjusted year - If the latter be included, the load factor is 69.0%.

difference in the seasonal peak demands. In the actual year 1952-53, the months of September, October and March were the highest - with the Winter months being somewhat lower. On the adjusted year basis, the coincident peak demand, as developed, would occur in the month of January in the amount of 89,315 Kw, exclusive of the Kaiser load, as compared to a non-simultaneous demand for the year of 130,621 Kw - thus resulting in a diversity of 1.46. (See Appendix C-1).

In column (f), the Excess Demands by Classes are shown, which amounts are computed as the difference between the class non-simultaneous demands and the average demands. In the last column, the annual load factors for each class are set down for information. The system load factor is 69% (Appendix C-1) and clearly shows the effect of diversity between classes.

The relationship of the Kilowatt hours between classes and the relationship of the Excess Demand values as between the classes, forms the basis of spreading the Commodity and Demand Costs developed in Table 1.

<u>Equivalent Customer Determination</u>:

For the San Francisco Municipal loads, there is set forth in Table 3 both the number of meters and the equivalent number of meters. The latter is developed by assigning an index or multiplier to each group upon the basis of an index of 1.0 to the Domestic service. Domestic service is taken as unity, since it represents the lowest cost type of service and with larger services expressed as some multiple of the Domestic. The Domestic is single phase, requiring minimum size of service wires and meters. Cost of reading meters, computing bills, and collection are also low - all in contrast to the much higher customer costs that are

TABLE 3

EQUIVALENT CUSTOMER DETERMINATION

Adjusted Year 1952 - 53

HETCH HETCHY POWER DIVISION

Classification	Number of Accounts (Meters) (a)	Multi-plier (b)	Equivalent Number (c)
I - SAN FRANCISCO MUNICIPAL LOAD:			
1 - Railway A. C.	35	10	350
2 - Railway D. C.	47	10	470
3 - Railway Total	82		820
4 - Street Lighting	45	5	225
5 - a. Traffic Signals - Meters	14	2	28
b. Traffic Signals - Intersections (non metered)	529	1	529
6 - Street Lighting and Traffic Signals	588		782
7 - Crystal Springs Pumps	1	10	10
8 - All other Municipal Load:			
a. Airport			
(1) Schedule C-6	3	5	15
(2) Other Accounts	6	2	12
(3) Total Airport	9		27
b. Balance			
(1) Flat Rate of 2.75¢ per Kwhr	295	1	295
(2) Schedule C-1	81	5	405
(3) Schedule C-6	9	5	45
(4) Schedule D-1	4	1	4
(5) Schedule D-5	2	1	2
(6) Schedule D-6	9	1	9
(7) Schedule DA-6	2	1.5	3
(8) Schedule L-1	178	1.5	267
(9) Schedule L-5	2	1.5	3
(10) Schedule L-6	15	1.5	23
(11) Schedule L-21	2	1.5	3
(12) Flat Rate of 2.0¢ per Kwhr	188	1	188
(13) Schedule H-1	4	2.5	10
(14) Schedule P-1	10	2.5	25
(15) Schedule P-3	8	2.5	20
(16) Schedule P-5	1	5	5
(17) Schedule P-15	10	5	50
(18) Schedule P-17	1	5	5
(19) Total Balance	821		1362
9 - Total San Francisco Municipal	1501		3001

incurred from Commercial and Industrial power loads. It will be observed, too, that the "Balance" of Municipal Service is broken down into 18 sub-groups.

The equivalent number of customers in column (c) becomes the basis of spreading the Customer Costs, developed in Table 1, as between the classes.*

The Customer cost assignment to the Non-Municipal loads is based upon an individual analysis of each customer. These are all large Power loads, served from transmission, with known investments that are for the exclusive use of each of the customers. From these investments, Customer costs have been computed, with an allowance for reading meters, billing, and collecting expense.

Cost Allocation to Classes:

The first step is to determine the unit Commodity, Demand and Customer costs at both Power and Distribution Pool levels. Such development is set forth in Table 4.

In this development, the system Demand, Commodity and Customer costs, as set forth in Table 1, are brought forward to Table 4, along with the Demands (excess) in kilowatts and kilowatt hours figures from Table 2. The number of customers, three in number, are also included. From these, the unit costs at production for both the Power Pool and Distribution Pool are developed.

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* For example, the total customer cost component of $106,680 from Table 1, for the Distribution Pool, is divided by 3001 (the equivalent number of customers) giving a unit customer cost of $35.52 (Table 4).

The customer assignment for Railway - A. C., for example, becomes its equivalent number of customers - namely 350 times $35.52, or $12,433 - as developed in Table 6, Sheet 1.

TABLE 4

UNIT COST DETERMINATION

Adjusted Year 1952 - 53

HETCH HETCHY POWER DIVISION

Item	Allocated Amount (a)	Basic Quantities At Production (b)	Unit Cost At Production (c)
A. With 4.35% Return:			
1 - Power Pool			
a - Demand (Excess)	$ 876,603	71,499 Kw	$12,26035
b - Commodity	1,827,787	517,903,548 Kwhr	0.3529203¢
c - Customer	242,511	3 large	$80,837*
2 - Distribution Pool (Inclusing Wheeling)			
a - Demand (Excess)	$ 285,190	45,364 Kw	$6.2867*
b - Commodity	634,777	236,111,479 Kwhr	0.268846¢*
c - Customer	106,680	3,001 (Equiv.)	$35.5215
B. With 5.7% Return:			
1 - Power Pool			
a - Demand (Excess)	$1,006,047	71,499 Kw	$14.0708
b - Commodity	2,115,905	517,903,548 Kwhr	0.408552¢
c - Customer	243,914	3 large	$81,305*
2 - Distribution Pool (Including Wheeling)			
a - Demand (Excess)	$ 285,190	45,364 Kw	$6.2867*
b - Commodity	634,777	236,111,479 Kwhr	0.268846¢*
c - Customer	106,680	3,001 (Equiv.)	$35.5215

Source of quantities and development:

1 - Column (a) amounts taken from Table 1
2 - Column (b) quantities taken from Table 2
3 - Column (c) unit costs are obtained by dividing column (a) by column (b)

* Unit average figures are shown - See Table 6 for detailed breakdown by classes.

Due to variation in the Wheeling Charges for the different classes, the unit costs for each of the Municipal loads at Distribution level change. There are no Distribution Power Pool charges to the Irrigation and Commercial loads.

In Table 5, the Wheeling Charges by classes, along with the class allocations are set forth.

The base Wheeling Charges, per Table 5, are in accordance with the "Main Contract" with Pacific Gas and Electric Company as of March 14, 1945, and as that has been modified through Supplemental Agreements. These class "Wheeling Costs" are distributed to Demand and Commodity in the relationship of 31 and 69 per cent, respectively, after first providing for a Customer allocation. These developed class costs, in turn, are transferred to Table 6 and become a part of the total costs for each class under the Distribution Pool classification.

As inferred in the paragraph above, in Table 6 the actual development and summation of the indicated total costs to serve by each of the classes of service are set forth.

Reference to that Table will show that the San Francisco Municipal loads* are first set forth, followed by the Irrigation Districts and the Commercial. The kilowatt hour and Demand amounts for each class are transferred from Table 2. The unit costs are taken from Table 4. The product of these two provide the estimated total costs for each class. As seen, these are set up for both a 4.35% and 5.7% Return on the depreciated Capital investment used in providing the service. As

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* Under the part designated "All Other Municipal Load", the sub-heading "Balance" is given. This is made up of 18 sub-classes. The individual development is given in Appendix C-4.

the final step, the total annual costs for each class, made up of the Demand, Commodity and Customer components, are divided by the kilowatt hours of sales and there is thus obtained the indicated cost per kilowatt hour for each of the customer classes. This last step and resulting cost development is one of the principle objectives of the study.

TABLE 5

ALLOCATION OF WHEELING CHARGE TO MUNICIPAL LOADS

Adjusted Year 1952 - 53

HETCH HETCHY POWER DIVISION

A - Basis of Billing of San Francisco Municipal Load

Basis of Billing of San Francisco Municipal Load	Kwhr at Meter	Wheeling Charge: Charge Per Kwhr Per Contract	Wheeling Charge: Total Charge
	(a)	(b)	(c)
(1) Railway A. C.	49,490,790	$0.001506	$ 74,533
(2) Railway D. C.	27,053,065	0.004183	113,163
(3) Total Railway	76,543,855	0.002452	$187,696
(4) Street Lighting	33,406,434	0.006421	$214,503
(5) Traffic Signals	1,887,405	0.006421	12,119
(6) Total Street Lighting & Traffic Signals	35,293,839	0.006421	$226,622
(7) Crystal Springs Pumps	14,022,400	0.001634	22,913
(8) All Other Loads (Municipal)			
(9) a - Airport	19,358,452	0.006671	129,140
(10) b - Balance	45,968,344	0.008345	383,606
(11) Total All Other Municipal	65,326,796	$0.007849	$512,746
(12) Total For Municipal Load	191,186,890	$0.004969	$949,977

B - Segregation of Wheeling Charges to Demand, Commodity and Customers

Item	Total	Demand Amount	Demand %	Commodity Amount	Commodity %	Customer Amount	Customer %
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
(1) Railway A. C.	$ 74,533	$ 22,020	29	49,013	66	3,500	5
(2) Railway D. C.	113,163	33,624	30	74,839	66	4,700	4
(3) Total Railway	187,696	55,644	30	123,852	66	8,200	4
(4) Street Lighting	214,503	65,798	31	146,455	68	2,250	1
(5) Traffic Signals	12,119	2,030	17	4,519	37	5,570	46
(6) Total St. Ltg. & Tr. Sign'ls	226,622	67,828	30	150,974	67	7,820	3
(7) Crystal Springs Pumps	22,913	7,072	31	15,741	69	100	-
(8) All Other Loads (Municipal)							
(9) a - Airport	129,140	39,950	31	88,920	69	270	-
(10) b - Balance	383,606	114,696	30	255,290	66	13,620	4
(11) Total All Other Municipal	$512,746	154,646	30	344,210	67	13,890	3
(12) Total Municipal Loads	$949,977	$285,190	30	634,777	67	30,010	3

CLASS COST COMPUTATIONS

Adjusted Year 1952 - 53

HETCH HETCHY POWER DIVISION

Class of Service	Basic Quantities	With 4.35% Return: Unit Cost	With 4.35% Return: Total Cost	With 5.7% Return: Unit Cost	With 5.7% Return: Total Cost
	(a)	(b)	(c)	(d)	(e)
I-SAN FRANCISCO MUNICIPAL LOAD:					
1. Railway A. C.					
Power Pool-Demand (Excess) Kw	8,811	$12.26	$108,256	$14.07	$123,978
-Commodity Kwhr	57,469,455	0.353¢	202,805	0.409¢	234,802
-Customer	350	-	-	-	-
Dist. Pool-Demand (Excess) Kw	8,811	$ 2.499	22,020	$ 2.499	22,020
-Commodity	57,469,455	0.085¢	49,013	0.085¢	49,013
-Customer (Equiv.)	350	$35.52	12,433	$35.52	12,433
Total			394,527		442,246
Unit Cost Per Kwhr Sold	49,490,790	0.797¢		0.894¢	
2. Railway D. C.					
Power Pool-Demand (Excess) Kw	6,973	$12.26	$ 85,491	$14.07	$ 98,116
-Commodity Kwhr	36,350,617	0.353¢	128,279	0.409¢	148,517
-Customer	470	-	-	-	-
Dist. Pool-Demand (Excess) Kw	6,973	$ 4.822	33,624	$ 4.822	33,624
-Commodity Kwhr	36,350,617	0.206¢	74,839	0.206¢	74,839
-Customer (Equiv.)	470	$35.52	16,695	$35.52	16,695
Total			338,928		371,791
Unit Cost Per Kwhr Sold	27,053,065	1.253¢		1.374¢	
3. Railway Total Cost			$733,455		$814,037
Unit Cost Per Kwhr Sold	76,543,855	0.958¢		1.063¢	
4. Street Lighting					
Power Pool-Demand (Excess) Kw	5,582	$12.26	$ 68,437	$14.07	$ 78,543
-Commodity Kwhr	39,567,366	0.353¢	139,629	0.409¢	161,659
-Customer	225	-	-	-	-
Dist. Pool-Demand (Excess) Kw	5,582	$11.79	$ 65,798	$11.79	$ 65,798
-Commodity Kwhr	39,567,366	0.370¢	146,455	0.370¢	146,455
-Customer	225	$35.52	7,992	$35.52	7,992
Total			428,311		460,447
Unit Cost Per Kwhr Sold	33,406,434	1.282¢		1.378¢	
5. Traffic Signals					
Power Pool-Demand (Excess) Kw	25	$12.26	307	$14.07	352
-Commodity Kwhr	2,245,567	0.353¢	7,890	0.409¢	9,133
-Customer	557	-	-	-	-
Dist. Pool-Demand (Excess) Kw	25	$81.20	2,030	$81.20	2,030
-Commodity Kwhr	2,235,567	0.202¢	4,519	0.202¢	4,519
-Customer	557	$35.52	19,785	$35.52	19,785
Total			34,531		35,819
Unit Cost Per Kwhr Sold	1,887,405	1.830¢		1.898¢	
6. Street Ltg. & Traffic Sig.-Total Cost			$462,842		$496,266
Unit Cost per Kwhr Sold	35,293,839	1.311¢		1.406¢	

CLASS COST COMPUTATIONS

Adjusted Year 1952 - 53

HETCH HETCHY POWER DIVISION

Class of Service	Basic Quantities	With 4.35% Return Unit Cost	With 4.35% Return Total Cost	With 5.7% Return Unit Cost	With 5.7% Return Total Cost
	(a)	(b)	(c)	(d)	(e)
7. Crystal Springs Pumps					
Power Pool-Demand (Excess) Kw	451	$12.26	$ 5,592	$14.07	$ 6,346
-Commodity Kwhr	16,412,786	0.353¢	57,919	0.409¢	67,058
-Customer	10	-	-	-	-
Dist. Pool-Demand (Excess) Kw	451	$15.68	7,072	$15.68	7,072
-Commodity Kwhr	16,412,786	0.096¢	15,741	0.096¢	15,741
-Customer (Equiv.)	10	$35.52	355	$35.52	355
Total			86,616		96,572
Unit Cost Per Kwhr Sold	14,022,400	0.618¢		0.689¢	
8. All Other Municipal Load					
a. Airport					
Power Pool-Demand (Excess) Kw	2,801	$12.26	$ 34,341	$14.07	$ 39,412
-Commodity Kwhr	23,773,245	0.353¢	83,894	0.409¢	97,130
-Customer	27	-	-	-	-
Dist. Pool-Demand (Excess) Kw	2,801	$14.26	39,950	$14.26	39,950
-Commodity Kwhr	23,773,245	0.374¢	88,920	0.374¢	88,920
-Customer (Equiv.)	27	$35.52	959	$35.52	959
Total			248,064		266,371
Unit Cost Per Kwhr Sold	19,358,452	1.281¢		1.376¢	
b. Balance					
Power Pool-Demand (Excess) Kw	20,721	$12.26	$254,047	$14.07	$ 291,561
-Commodity Kwhr	60,302,443	0.353¢	212,802	0.409¢	246,376
-Customer	1,362	-	-	-	-
Dist. Pool-Demand (Escess) Kw	2,071	$5.535	114,696	$5.535	114,696
-Commodity Kwhr	60,302,443	0.423¢	255,290	0.423¢	255,290
-Customer (Equiv.)	1,362	$35.52	48,380	$35.52	48,380
Total			885,215		956,303
Unit Cost Per Kwhr Sold	45,968,344	1.926¢		2.080¢	
c. Sub-total All Other Mun. Load			$1,133,279		$1,222,674
Unit Cost Per Kwhr Sold	65,326,796	1.735¢		1.872¢	
9. Total S. F. Municipal Load			$2,416,192		$2,629,549
Unit Cost Per Kwhr Sold	191,186,890	1.264¢		1.375¢	
II-IRRIGATION DISTRICT LOAD:					
1. Modesto Irrigation District					
Power Pool-Demand (Excess) Kw	18,153	$12.26	$ 222,562	$14.07	$ 255,427
-Commodity Kwhr	139,822,459	0.353¢	493,421	0.409¢	571,269
-Customer					
Special Facilities	1	$11,795	11,795	$13,198	13,198
Accounting	1	$ 1,000	1,000	$ 1,000	1,000
Dist.Pool-Demand (Excess) Kw	-	-	-	-	-
-Commodity Kwhr	-	-	-	-	-
-Customer	-	-	-	-	-
Total			728,778		840,894
Unit Cost Per Kwhr Sold	136,279,200	0.535¢		0.617¢	

CLASS COST COMPUTATIONS

Adjusted Year 1952 - 53

HETCH HETCHY POWER DIVISION

Class of Service	Basic Quantities	With 4.35% Return: Unit Cost	With 4.35% Return: Total Cost	With 5.7% Return: Unit Cost	With 5.7% Return: Total Cost
	(a)	(b)	(c)	(d)	(e)
III-COMMERCIAL LOADS (FIRM)- Hetch Hetchy Portion					
1. Riverbank Ordnance Plant					
Power Pool-Demand (Excess) Kw	4,207	$12.26	$ 51,579	$14.07	$ 59,196
-Commodity Kwhr	5,629,728	0.353¢	19,867	0.409¢	23,001
-Customer	1	$600	600	$600	600
Dist. Pool-Demand (Excess) Kw	-	-	-	-	-
-Commodity Kwhr	-	-	-	-	-
-Customer	-	-	-	-	-
Sub-Total-Hetch Hetchy Portion			72,046		82,797
Unit Cost Per Kwhr-Hetch Hetchy	5,487,065	1.313¢		1.509¢	
Supplemental Power-P.G.&E. Co.					
-Demand Kw-Months	18,562	-	-	-	-
-Energy Kwhr	9,846,381	0.910¢	89,582	0.910¢	89,582
Total			161,628		172,379
Unit Cost Per Kwhr Sold	15,303,302	1.056¢		1.126¢	
2. Permanente Cement Plant					
Power Pool-Demand (Excess) Kw	3,775	$12.26	$ 46,283	$14.07	$ 53,117
-Commodity	136,339,882	0.353¢	481,133	0.409¢	557,040
-Customer	1	$52,943	52,943	$52,943	52,943
Dist. Pool-Demand (Excess) Kw	-	-	-	-	-
-Commodity Kwhr	-	-	-	-	-
-Customer	-	-	-	-	-
Sub-total-Hetch Hetchy Portion			580,359		663,100
Unit Cost Per Kwhr - Hetch Hetchy	128,397,283	0.452¢		0.516¢	
Supplemental Power P.G.&E. Co.					
-Demand Kw-Months	26,531		26,418		26,418
-Energy Kwhr	14,464,091		60,173		60,173
Sub-total P.G.&E. Supplemental			86,591		86,591
Unit Cost Per Kwhr-PG&E Energy	14,306,717	0.605¢		0.605¢	
Total			666,950		749,691
Unit Cost Per Kwhr Sold	142,704,000	0.467¢		0.525¢	
3. Total Commercial (Firm)			828,578		922,070
Unit Cost Per Kwhr Sold	158,007,302	0.524¢		0.584¢	
IV-TOTAL CLASSES I, II, and III:			$3,973,548		$4,392,513
Unit Cost Per Kwhr Sold	485,473,392	0.818¢		0.905¢	

Summary Of Cost Allocations And Comparisons:

The costs, as allocated to each of the classes and sub-classes of service, are brought forward and summarized in Table 7. There is also included revenue at both present rates and at a competitive level - termed "Alternate". It will be of interest to compare the costs and revenues on a unit basis. On the basis of costs, at a 4.35% return, and revenues at present rates as charged, the results are:

Class Of Service	Cents Per Kilowatt Hour Cost		Revenue	
I - San Francisco Municipal:				
1 - Railway - A. C.	0.797		0.824	
2 - Railway - D. C.	1.253		1.117	
3 - Combined - Railway		0.958		0.928
4 - Street Lighting	1.282		1.344	
5 - Traffic Signals	1.830		2.125	
6 - Combined St. Lighting & Signals		1.311		1.386
7 - Crystal Springs Pumps		0.618		0.810
8 - All other Municipal Load:				
a - Air Port	1.281		0.840	
b - Balance	1.926		1.510	
c - Combined - All Other		1.735		1.311
9 - Total Municipal		1.264		1.135
II - Irrigation Districts:				
1 - Modesto and Turlock		0.535		0.411
III - Commercial Loads - Firm				
1 - Riverbank Ordnance	1.056		0.919	
2 - Permanente Cement	0.467		0.773	
3 - Combined Commercial		0.524		0.787
IV - Combined - Classes I, II, and III		0.818		0.818

Comments On Results Developed:

I - San Francisco Municipal:

Railway Service:

Costs at 4.35% return, and revenues at present rates, are in close harmony. Railway A.C. service, with a load factor of 42.7% shows present revenues to be about 3.4% higher than costs; while the D.C.

SUMMARY OF COST ALLOCATIONS WITH REVENUE COMPARISONS
ADJUSTED YEAR 1952-53
HETCH HETCHY POWER DIVISION

Table 7

Classification	Revenues Adjusted Year '52/53 (a) (Appendix A-4)	Estimated Costs at Returns of 4.35% (b) (Table 6)	Estimated Costs at Returns of 5.7% (c) (Table 6)	Revenue Per kwhr Present (d) (Appendix A-4)	Unit Cost per kwhr at 4.35% Return (e) (Table 6)	Unit Cost per kwhr at 5.7% Return (f) (Table 6)	Revenue Per kwhr Alternate Appendix A-4a (g) (Appendix A-4)
I San Francisco Municipal Load							
1. Railway AC	$ 407,993	$ 394,527	$ 442,246	0.824¢	0.797¢	0.894¢	1.072¢
2. Railway DC	302,259	338,928	371,791	1.117	1.253	1.374	1.460
3. Subtotal Railway	710,252	733,455	814,037	.928	0.958	1.063	1.209
4. Street Lighting	448,994	428,311	460,447	1.344	1.282	1.378	1.797
5. Traffic Signals	40,100	34,531	35,819	2.125	1.830	1,898	2.443
6. Subtotal St. Ltg. & Tr. Sigs.	489,094	462,842	496.266	1.385	1.311	1.406	1.832
7. Crystal Springs Pumps	113,537	86,616	96,572	0.810	0.618	0.689	0.827
8. All other Municipal Load							
a. Airport	162,610	248,064	266,371	0.840	1.281	1.376	0.984
b. Balance							
(1) Flat 2.75c per kwhr	36,580	40,069	42,672	2.75	3.013	3.209	3.36
(2) Schedule C-1	387,350	518,656	560,590	1.27	1.694	1.831	1.42
(3) Schedule C-6	16,058	20,524	22.108	1.44	1.837	1.978	1.58
(4) Schedule D-1	445	745	797	1.35	2.269	2.428	1.59
(5) Schedule D-5	119	160	168	2.77	3.717	3.902	3.34
(6) Schedule D-6	1,078	1,301	1,383	1.86	2.239	2.380	2.20
(7) Schedule DA-6	503	529	564	1.92	2.016	2.149	2.37
(8) Schedule L-1	125,611	121,382	131,146	2.37	2.291	2.475	2.67
(9) Schedule L-5	1,596	1,051	1,131	3.14	2.068	2.225	3.58
(10) Schedule L-6	5,607	3,838	4,094	3.36	2.297	2.450	3.84
(11) Schedule L-21	169	196	204	3.94	4.575	4.762	5.53
(12) Flat 2.0c per kwhr	36,240	53.761	57.996	2.00	2.967	3.201	2.72
(13) Schedule E-1	2,250	3,182	3,416	1.29	1.830	1.965	1.59
(14) Schedule P-1	4,790	4,898	5,237	2.12	2.164	2.313	2.41
(15) Schedule P-3, -13	22,463	41,301	44,931	1.37	2.526	2.748	1.61
(16) Schedule P-5	15,912	31,883	34,850	1.88	3.763	4.114	1.92
(17) Schedule P-15	32,765	38,442	41,459	1.41	1.649	1.778	1.54
(18) Schedule P-17	3.669	3,297	3,557	1.95	1.756	1.895	2.34
(19) Miscellaneous *	1,019	-	-	-	-	-	
(20) Subtotal Balance	694,224	885,215	956,303	1.51	1.926	2.080	1.717
c. Subtotal All Other Mun. Ld.	856,834	1,133,279	1,222,674	1.311	1.735	1.872	1.717
9. Total S.F. Municipal Load	2,169,717	2,416,192	2,629,549	1.135	1.264	1.375	1.395
II Irrigation District Load							
1. Modesto Irrigation District	559,628	728,778	840,894	0.411	0.535	0.617	0.454
III Commercial Loads (Firm)							
1. Riverbank Ordnance Plant	140,673	161,628	172,379	0.919	1.056	1.126	0.919
2. Permanente Cement Plant	1,103,530	666,950	794,691	0.773	0.467	0.525	0.773
3. Total Commercial Firm	1,244,203	828,578	922,070	0.787	0.524	0.584	0.787
IV Total Classes I, II and III	$3,973,548	$3,973,548	$4,392,513	0.818¢	0.818¢	0.905¢	0.933¢

* This Miscellaneous item includes some intermittent sales and others of minor amounts wherein there is lacking complete information.

service, with an annual load factor of 37.3% and requiring conversion from A.C. to D. C., indicates revenues are somewhat low (10.9%); and that for the combined service, revenues are but slightly low - 3.2%.

The Wheeling Charge for transporting the energy from Newark to the terminal substations, performing the transformation, making the delivery at 82 points, and metering, is approximately 1.5* mills for the A.C. and 4.2 mills per kilowatt hour (see Table 5) exclusive of a payment in kilowatt hours for line losses (See Appendix C-2). The net revenue realized by Hetch Hetchy at Newark for the Railway delivery is 6.56 mills per Kwhr. The average cost is 6.86 mills at the load factor served.

This indicates that, at a 4.35% return, the revenues available after meeting costs at Distribution, are about 4.5% low.** At the 5.7% return, present revenues would fall 17.2% below costs. All costs are predicated at kilowatt hours at meter.

Street Lighting Service:

At the 4.35% return, costs developed are less than revenues by 4.6% and, at 5.70% return, costs exceed revenues by but 2.5%.***

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* From Table 5, the Wheeling Charges are divided by the kilowatt hours at the meter - thus:
Railway A.C. $ 74,533 divided by 49,490,790 Kwhr equals 1.506 Mills
Railway D.C. $113,163 divided by 27,053,065 Kwhr equals 4.183 Mills

**	Total Cost	Mills Per Kwhr at Meter
Present Revenue (Table 7)	$710,252	9.28
Less Dist. Costs(Table 6-pg.1)	208,624	2.72
Balance of Revenue for Power Pool Costs	501,628	6.56
Power Pool Costs(Table 6-pg.1)	524,831	6.86
Indicated Deficiency	$ 23,103	0.30-or 3.2% low

In reference to total revenue of 9.28 mills, or 4.5% as to Power Pool costs of 6.86 Mills.

*** With no impact for Income Taxes, a fairly substantial change can be made in the rate of return with but nominal effect on revenues - i.e., each dollar change in net produces the same change in gross revenue. With a 4% State and a 52% Federal Income Tax, now effective on investor-owned utilities, each dollar change in net revenue requires 2.17 dollars in gross revenue.

The charge for moving the Street Lighting energy from Newark is 6.4 mills per Kwhr. This leaves a balance of the revenue for payment of Hetch Hetchy deliveries at Newark of 6.85 mills per Kwhr, against an indicated cost of 6.23 mills - a margin of 10%. At the higher rate of return, costs rise to 7.19 mills and are over present available revenues at Newark by approximately 4.7%. The 6.85 and 6.23 figures become 6.07 and 5.52 mills per Kwhr for kilowatt hours of delivery at Newark, as contrasted with those at the meter, upon which the first group are computed.

Traffic Signals:

This is a comparatively small service as to kilowatt hours, and it is usually considered in conjunction with Street Lighting. Most of the service is unmetered, but a careful estimate is made of the kilowatt hours of use for each signal served.

The revenues are shown to exceed the indicated costs (4.35% basis) by approximately 16.1%. The excess is nearly as great at 5.70% - namely, 10%. The Wheeling Charge is the same as for Street Lighting.

The favorable costs arise from the very high load factor of 91% which may well be too high, but which was developed from the basic data used. The revenues are in the neighborhood of 1% of the total system.

Crystal Springs Pumps:

This is a favorable load to serve. The voltage of delivery is 2300 - stepped down by Pacific Gas and Electric from 60 Kv. The annual load factor is high - namely 82.7%. The Wheeling Charge is low, amounting to 1.6 mills per Kwhr. Total costs at the lower rate of return amount to 6.18 mills against a present revenue of 8.10 mills - thus,

revenues are over indicated costs by 31.0%.

Indicated costs for deliveries at Newark - i.e., for the Power Pool component - are 4.53 mills per Kwhr. This compares with the balance of revenue, after meeting Wheeling and other Distribution Pool costs, for the Power Pool service of 6.44 mills per Kwhr. At 5.70% return, the 4.53 amount becomes 5.24 mills.

<u>All Other Municipal Load</u>:

<u>a - Airport</u>:

Costs, as developed, are substantially higher than revenues - namely, 12.81 mills at a 4.35% return, as compared with a revenue of 8.40 mills per Kwhr. This results in an indicated deficiency of 4.41 mills, or 34.4%.

Distribution costs of 6.70 mills carry a Wheeling Charge of 6.67 mills. This only leaves 1.70 mills (8.40-6.70) to provide for production and transmission to Newark. The study indicates these latter costs amount to 6.11 mills per Kwhr. Costs at the 5.7% return for delivery at Newark amount to 7.05 mills, and at the meter, 13.76 mills per Kwhr - thus a still greater indicated deficiency with the higher rate of return results.

The load characteristics of the service are good, as the annual load factor is 49.2%.

b - <u>Balance of the Municipal Load</u>:

This group is made up of approximately 18 sub-classifications, as set forth in Table 7. The analysis of these accounts as a whole shows that the hours of use are low in relation to the demands imposed - in other words, in more technical language, the average load factors are

low - for the group as a whole, it is approximately 25%.

The average cost per Kwhr at 4.35% return is 1.735¢ (17.35 mills), as compared to a revenue of but 1.311¢ - making an indicated deficiency of 0.424¢ (4.24 mills) per Kwhr, or 24.4%.

Distribution Pool costs of 9.10 mills carry Wheeling Charges of 8.3 mills per Kwhr. The revenue left, after providing for the full Distribution Pool costs at 4.35% return, is 6.00 mills. The costs as developed are 10.16 mills. For a further discussion of some of the individual groups, please turn to Appendix C-4.

II - Irrigation District Loads:

Next to the City's own Municipal loads, service to the Irrigation Districts for pumping water and for municipal uses, has priority over other customers for deliveries from Project production. Sales made (Appendix C-2), exclusive of the miscellaneous, accounted for 28% of the total; while revenues received represented 14%. This latter indicates the wholesale nature of the service and the fact it was sold at a low rate.

The District's load characteristics are, in part, dependent on climatic conditions. Fairly heavy demands occur both in the Fall and Winter seasons. The annual load factor for the adjusted year is 46.8% (Table 2).

Inasmuch as the deliveries are made directly off the main 115 Kv transmission circuits of the City through tap lines to the District's Station "J", there are no Distribution Pool costs involved in serving the load. There is included a Customer Cost Assignment limited essentially to the operation and maintenance and carrying charges on the

investment in the metering and related equipment.*

Reference to Table 7 shows that the developed cost to serve the District's load at a 4.35% return is in the amount of 5.35 mills per Kwhr. This compares with an average revenue of 4.11 mills - indicating a deficiency of 1.24 mills per Kwhr, or 30.2% on the purchase price, and 23.2% on the indicated cost to serve. At the higher return, the cost is 6.17 mills per Kwhr.

III - Commercial Loads (Firm):

Riverbank Ordnance:

Under the agreements arising out of the disposition of Hetch Hetchy electric production under the Raker Act, any supplemental purchases from Pacific Gas and Electric, to make up Project difficiencies to supply loads, must first be applied to the requirements of the Riverbank Ordnance plant.

The City has no Customer investment specifically made to service this load.The customer installation is owned entirely by the United States Government.

Reference to Table 6 will show that deliveries were made from both Project Power and Supplemental purchases from Pacific Gas and

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* The City's ownership in Station "J" includes two switch towers, one on each side of the tap connectors, together with high voltage metering equipment, which includes a meter tower, disconnect switches, potential and current transformers, and a recording watt hour meter. The installation was completed in April 1948 at a cost of $63,622,86.

In 1952, the District increased the capacity of Station "J" and this required the City to install a second meter and associated equipment at a cost of approximately $40,300.

Electric under the adjusted year basis.

At the comparatively small use in kilowatt hours in reference to demands, the annual load factor is very low - namely 13.3% on Project deliveries and 26.0% on the Supplemental. Project costs under these conditions work out to 13.13 mills per Kwhr at 4.35% return and purchases at 9.10 mills for deliveries plus losses. The average combined cost for metered consumption is 10.56 mills per Kwhr at 4.35% return. This compares with a revenue of 9.19 mills per Kwhr. Costs at 5.7% return indicate a cost of 11.26 mills. Power purchases may be viewed as the best measure of costs, as practically all deliveries are normally obtained from such source.

Permanente Cement Plant:

This is a large and excellent load. Its operations are very uniform. The annual load factor is nearly 90%. In preference for use of Project energy, the Cement load comes ahead of other Commercial services.

The service is in effect wholesale and rendered at transmission voltage. From Newark, the Permanente and Kaiser loads carry the full rental charges for the 110 Kv and 60 Kv lines to transport the energy.

The load statistics (Table 2) show that approximately 90% of the Cement Company's supply was of Project origin. As the Municipal and Irrigation loads grow, a much larger per cent will become Supplemental energy purchases.

Reference to Tables 6 and 7 shows that the indicated costs to serve are very low - namely 4.67 mills at the 4.35% return, and 5.25 mills at 5.7% return. Revenues under present rates yield 7.73 mills per Kwhr.

Project costs, at transmission, give 3.87 mills at the present high load factor of use. Supplemental purchases cost 6.05 mills. The Customer costs add approximately $53,000 a year. The average cost for kilowatt hours at the meter yield the 4.67 mills previously noted.

Kaiser Aluminum and Chemical Corporation:

As previously noted, service to the Aluminum Plant is subject to interruption. In the Study, revenue from this service has been treated as a credit to costs of operation and no costs have been developed in Summary Table 7.

Costs, however, have been developed in order to learn what the probable impact on Project earnings are to provide the service.

On the adjusted year basis, with Project deliveries supplying about 44% of the total, the indicated costs are:

	Cost Total	Mills Per Kwhr At Newark	Mills Per Kwhr At Meter
Project Deliveries: 3,559,124 Kwhr	$25,241	7.09	
Supplemental Purchases: 4,320,000 Kwhr	16,589	3.84	
Sub-total	41,830	5.31	5.43
Customer Costs:	2,657	0.34	0.34
Total (7,879,124 Kwhr Delivery to Kaiser)	$44,487	5.65	
Average Cost for Kwhr at Meter (7,704,000 Kwhr)		5.77	5.77

Revenues realized from sales would amount to $52,441, or 6.81 mills per Kwhr (7,704,000 Kwhr).

If all the deliveries had been from Supplemental purchases, the average cost would have been 4.19 mills, based upon 7,704,000 Kwhr and 15,120 Kw months. In the Project cost, a Demand component is included in the amount of $12,677,which is equivalent to 3.56 mills.

This would leave 3.53 mills for the Commodity portion (7.09 - 3.56). If the 3.53 mills cost be increased by the Customer cost of 0.34 mills, the result would be 3.87 mills (4.06 at the meter). The latter could be looked at as the incremental cost to serve by the City. Supplemental Power purchases from Pacific Gas and Electric are also on an incremental basis,* as the service is subject to curtailment.

It is the conclusion that revenues derived from the Kaiser Aluminum load adequately cover costs on any incremental basis. When the load is furnished from Supplemental purchases, the advantage increases, as the rate charged by Pacific Gas and Electric is also on an incremental basis. It may be expected that, in the future, under existing Project development, most of the sales to Kaiser Aluminum will be obtained by Supplemental purchases.

In this study, the impact of serving Kaiser Aluminum is very small. To the extent there is an advantage, it is favorable to the other loads as herein handled.

The services in Tuolumne County are also viewed as very insignificant cost-wise. The handling the revenues as a credit has no material impact on the results of the study in either increasing or

* Under a letter agreement, dated November 19, 1952, supplementing an April 18, 1945 Contract, the City is to pay Pacific Gas and Electric Company the following rate for deliveries of Supplemental power for Kaiser Aluminum:

$0.30 per Kw of the maximum demand each month, plus
3.6 mills per Kwhr.

The April 18, 1945 contract provided that Pacific Gas and Electric could discontinue or partially curtail the delivery of the supplemental purchases for the then Magnesium Plant (now Aluminum Plant) in the event Pacific Gas and Electric discontinued or curtailed the delivery of electric energy to consumers receiving service of the same type on its own system. Such curtailment provision was stated as in consideration of the low rates provided in the Contract.

decreasing the costs to the other classes.

The small dump sales to Pacific Gas and Electric do not usually take place - they did not in the recorded year studied - but would have resulted in the adjusted year because of some surplus generation in some months, due to the large loss in the Kaiser Aluminum load. However, it may be noted there was a similar actual dump sale this 1954-55 year. To have a market for every kilowatt hour that is generated from a hydro-plant must be viewed as a favorable condition. The rate realized is 2.9 mills per kilowatt hour, and the total revenue, $12,294. This generation and sale was likewise treated as a credit to cost of system operatinns.

In Chapter V, that follows, on Rate Analysis, present and proposed rates will be discussed and their resulting impact on the Power Division earnings will be presented.

CHAPTER V

RATE ANALYSIS

CHAPTER V

RATE ANALYSIS

Introduction:

In this next to the last Chapter, before Conclusions, it will be the purpose to review each of the different customer classifications of service from the point of view of the form and level of electric rates that reasonably may be established to yield certain dollars of revenue.

Chapter IV has made available a fairly comprehensive development as to the indicated costs to provide the service. Chapter III sets forth the earning position of both Divisions of Operation and for different rates of return.

In Chapter II there is developed the alternate or competitive level of revenue that might be realized if the service was not provided by the City.

All this material is viewed as excellent background and necessary information to intelligently set forth a suggested rate structure of each of the different classes.

At this time, it may be well to note that, from a system standpoint, it may be said that rates are predicated on the over-all Cost-to-Serve principle - i.e., if it is desired to realize 4.5 million dollars in gross revenues, then the class rates established must in total provide that amount. However, for the individual classes that go to make up the system, some classes may be expected to raise more and some less revenue than the costs for each of the classes.

In other words, Cost to Serve may be viewed as a valuable

guide and tool in the fixing of class rates, but not necessarily controlling.

There are many other considerations that those who have the responsibility for fixing rates normally may view as also of importance, depending upon the circumstances in each case. Some of these other elements include:

1 - The rates now charged

2 - The history of the rates and the territory served

3 - The value of the service concept - both from point of view of the customer and the Agency supplying the service

4 - Competitive conditions in respect to alternate services

5 - Rates charged by other Agencies

6 - Legal statute; and

7 - Public policy.

In a Municipal system, such as the Hetch Hetchy, the broader aspects that are associated with the public welfare concept to carry out the dictates of the Congressional Act under which the Project, in part, functions, as well as the City Charter, no doubt weigh heavily with the Public Utilities Commission and the Board of Supervisors in any decisions made.

In any Governmental service that has certain inherent cost savings at its level of operation in the way of taxes and lower cost of capital, the question arises - shall such be passed on in full in the form of lower utility rates, or shall some higher rates be charged in order that some net earnings may be realized:

1 - to assist in the capital expansion of the Project; and/or

2 - to provide monies for the General Fund for civic betterment and/or to provide a lesser tax rate to the citizens.

Attention may now be directed to each of the classes served from the viewpoint of rates.

I - San Francisco Municipal Loads:

Railway Service:

This service is billed under a City of San Francisco Schedule here designated as P9-A. The rate is as follows:

	Cents Per Kwhr	
Rate:	A.C.	D.C.
First 100 Kwhr per mo. per Kw of Max. demand	0.90	1.22
All over 100 Kwhr per Kwhr per Mo. per Kw of Max. demand	0.79	1.06
Monthly Minimum Charge:	A.C.	D.C.
Per Kw of Maximum demand	$1.86	$2.65

Presently Schedule P.R. of Pacific Gas and Electric became effective November 10, 1952. Rate PR(A) is as follows:

	Cents Per Kwhr	
	A.C.	D.C.
First 300 Kwhr per mo. per Kw of max. demand	1.08	1.46
All over 300 Kwhr per Kwhr per mo. per Kw of maximum demand	0.95	1.27
Monthly Minimum Charge:	A.C.	D.C.
Per Kw of maximum demand	$2.20	$3.20

A published tariff PR-S of the Public Utilities Commission and the Bureau of Light, Heat and Power of the City and County of San Francisco is as follows:

	Cents Per Kwhr	
	A.C.	D.C.
First 100 Kwhr per mo. per Kw of Max. demand	1.08	1.46
All over 100 Kwhr per mo. per Kw of max. demand	0.95	1.27
Monthly Minimum Charge:	A.C.	D.C.
Per Kw of maximum demand	$2.20	$3.20

Each of the rate tariffs provide for a Rate (b) of a Demand and Energy form. However, at the load factors of operation of the Railways,

Rate (A), that has been tabulated, provides the lower billing.

A comparison of present billings with that which would result under Schedule PR(A) of Pacific Gas and Electric Company, along with costs as developed in this study, is as follows:

Item	Municipal Railway Propulsion A.C.	D.C.	Total
Revenue:			
As billed - City's P-9-A	$407,993	$302,259	$710,252
Alternate Present PR-S	530,492	394,976	925,468
Alternate rate higher	122,499	92,717	215,216
Per cent higher	30.0%	30.7%	30.3%
Cost to Serve:			
At return of 4.35%	$394,527	$338,928	$733,455
Present revenues - lower	(13,466)	36,669	23,203
Per cent lower	(3.3%)	12.1%	3.3%
At return of 5.70%	$442,246	$371,791	$814,037
Present revenues - lower	34,253	69,532	103,785

If rates were boosted to the Alternate level, a substantial increase would result. If raised to a 5.7% return, nearly 15% increase would be required. Present charges return slightly less than the developed costs at the lower level of earnings.

Schedule PR-S, as published by the City, would result in the following comparative figures:

	A.C.	D.C.	Total
Revenue:			
As billed - City's P-9-A	$407,993	$302,259	$710,252
Under published City's Schedule PR-S(a)	490,273	361,976	852,249
Schedule PR-S(A) - higher	82,280	59,717	141,997
Per cent higher	20.2%	19.8%	20.0%

In the case of the Municipal Railway Service, the matter of public policy, as dictated to by the present rate level and the value of the service would appear to be the predominant factor. While this study has made no analysis of the financial operation of the Railway - from Press releases and the fact that local transportation systems

generally - whether publicly or privately owned and operated - have great difficulty in breaking even financially - it would seem that no increase in the rate structure to the Municipal Railway should be made. City transportation is apparently a type of service where the cost of providing it is fast approaching its value as appraised by the riding public. In any event, even on a cost basis, revenues do not compare badly with the cost of providing the electric service.

It is accordingly recommended that the present billing basis be continued.

Street Lighting:

The Street Lighting classification is somewhat complex. It may be broken down into four parts, as follows:

Class	Kwhr	Revenue Present	Revenue Alternate (P. G. & E.)	Revenue Amount Higher
1 - City Street Lights	32,921,398	$442,793	$593,111	$150,318
2 - Airport Street Lights	33,770	617	747	130
3 - Tunnels	438,014	5,214	6,004	790
4 - Airport - Miscellaneous	13,252	370	430	60
Total	33,406,434	$448,994	$600,292	$151,298

The indicated cost to serve for the group as a whole (Table 7) is:

At 4.35% return $428,311

At 5.70% return $460,447

1 - City Street Lights:

City Street Lighting necessarily represents the street lighting system for the City of San Francisco. It is particularly further identified in the main contract with Pacific Gas and Electric for the

disposal of Hetch Hetchy Power (dated March 14, 1945) in that Pacific Gas and Electric is not only to deliver the Hetch Hetchy energy to the lighting system, but is to maintain the street lamps. In this respect, the agreement provides, in part, under Schedule of Charges, as follows:

> "- - - Charges for street lighting services other than energy shall be the charges for street lighting services under schedules therefor as now existing or as hereafter revised, <u>less a credit equal to the quantity of energy delivered for street lighting purposes times 1.345 cents</u> per kilowatt hour." (Underscoring supplied)

The application of this clause means that, out of the total Street Lighting billing rendered by the Bureau of Light, Heat and Power to the City and County of San Francisco, Hetch Hetchy Power Division receives 1.345 cents* for each kilowatt hour billed. The balance of the billing is paid directly to Pacific Gas and Electric for Street Lighting maintenance and other costs - exclusive, however, of the Wheeling Charges of 6.421 mills per kilowatt hour paid by the Power Division itself, and therefore part of the costs in this study.

The estimate for the Alternate service was made under Schedule LS-5 where the rate covers only the furnishing of energy to street lamps (Electrolier Metered Rate). In view of the costs developed, this level of charges that are 33.8% higher must be viewed as a ceiling. It would represent an average charge of 1.80¢ per Kwhr contrasted with 1.345¢ now charged - or a total billing of $592,585 and resulting in an increase of $149,792.

The 4.35% return would provide a Street Lighting charge of

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* Hetch Hetchy gross receipts from Street Lighting may be checked - 32,921,398 Kwhr at 1.345¢ = $442,792.80

[illegible]

> [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

1.301¢ per Kwhr, while the higher rate of return would call for 1.399¢ - both in comparison with the present charge of 1.345¢ established 10 years ago.

Here again, it is a matter of broad City policy as to the level of the rate to be charged. The higher rate - say 1.40¢ - would represent but a 4 per cent increase, very modest; while 1.5¢ per Kwhr would amount to 11.5%.

In order not to increase the City's Street Lighting budget (and the tax rate), the Power Division might make a contribution equal to the increase. Such a procedure would show, in a tangible manner, some of the savings that the Power Division is accomplishing for the City of San Francisco in providing low electric rates.

The recommendation is that consideration be given to some plan wherein the dollar benefits - through lower rates - may be appraised, made known, and credited to the Power Division's operations.

Airport Street Lighting:

The present billing is on old Schedule L-34. The Alternate is priced out under the City's LS-5-S* tariff for meter rate street lighting - the same as LS-5 Street Lighting rate of Pacific Gas and Electric.

The indicated annual increase is $130, or 16.4%.

Tunnels:

Under this caption is included the lighting of the Stockton Street Tunnel and the Sunset and Twin Peak Tunnels, the latter being

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* Presently not effective.

[illegible]

of the Municipal Railway. The present billing is under Schedule L-34 and the Alternate is priced out under LS-5-S.

The annual increase would be $790, or 15.5%.

Airport - Miscellaneous:

These include Airport Accounts 4130-4 and 4130-6 which cover Airport Tower warning lights.

Street Lighting Schedule L-35 (outside of incorporated limits) is now applied. The Alternate is Schedule LS-6-S. The computed dollar increase is $59 a year, or 15.9%.

It is recommended that, for the miscellaneous Street Lighting items, each of the three be billed under the Alternate rate Schedules LS-5S and LS-6S.

Traffic Signals and Devices:

Under this classification are included traffic signals, beacon lights and crossing signals. About 5% of the traffic signals are metered out of a total of approximately 529 in number. All unmetered signals are classified by type and size - i.e., as to the number and size of lamps. The kilowatt hour standards of use are set up on a daily basis. The metered service is at a flat 2.7¢ charged per Kwhr. The unmetered service is covered under a designation SL 15, with a minor exception.

Revenue and cost comparisons follow:

	Revenues		Cost Estimates	
	Present	Alternate	4.35%	5.7%
Traffic Signals & Devices	$40,069	$46,084	$34,531	$35,819

With the large number of individual service connections and

somewhat limited information, it is quite possible that the cost estimates are not complete and are probably somewhat low. However, with the saving realized from a non-metered service, the costs should be lower than on a metered basis. Where metered service is predominantly used, it is common practice to price the consumption for traffic signals on the General Service Schedule. Such would mean Schedule A-1-S* of the City's and A-1 of Pacific Gas and Electric Company - both are identical.

It is recommended that the metered service be priced on Schedule A-1-S, General Service, and that no change be made in the unmetered billing. This would mean an increase of $459 a year on the metered service, or 16.8% - for traffic signals generally, the over-all increase would be the same dollar-wise, but the percentage increase would become 1.1%.

Crystal Springs Pumps:

Crystal Springs Pumps, used by the Water Department, provide favorable load characteristics, both as to power factor and load factor - the latter at approximately 80% on an annual basis. Voltage of delivery is 2300 - stepped down from transmission.

Service is now billed under old Schedule P-30. A comparison of costs and revenue amounts is:

	Revenues		Costs	
	Present	Alternate	4.35%	5.7%
Crystal Springs Pumps	$113,537	$116,023	$86,616	$96,572

The Alternate revenue is computed at A-13-S (Pacific Gas and

* Not effective.

Electric A-13) with a 4% discount for primary voltage delivery and power factor discount.

The developed costs carry a Wheeling Charge of 1.634 mills per Kwhr and reflect the favorable load characteristics of the operation of the pumps.

The alternate billing under A-13-S is viewed as a ceiling - the maximum that could normally be charged - and is viewed as too high at this time. In fact, present billings are 31% over the lower cost-to-serve and 18% over the costs carrying the 5.7% return. Consideration may well be given for a lower rate than now charged. Such a rate, P-30-S* has been developed and would provide** an annual billing of approximately $102,500 and a reduction of $11,000, or 9.7%.

The P-30-S Schedule is recommended for billing deliveries to the Crystal Springs Pumps.

<u>All Other Loads (Municipal)</u>:

<u>Airport</u>:

Present revenue is viewed as low, as the average revenue per Kwhr is but 8.4 mills. Costs as developed appear entirely reasonable,

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* Due to the limited application, a rate in the form of Schedule P-30 has been developed, and is as follows:

<u>Demand Charge</u>:

First 1000 Kw or less of maximum demand	$1,000 per month
Excess Kw of maximum demand	$0.70 per Kw per Mo.

<u>Energy Charge</u>:

First 150 Kwhr per Kw per month	0.8¢ per Kwhr
Next 150 " " " " "	0.7¢ " "
All over 300 " " " " "	0.5¢ " "

Minimum Charge per month - $1000.00

Special Conditions:

As per Schedule A-13S

** Includes 3% voltage discount and 0.5% for power factor.

especially since such must carry a Wheeling Charge of 6.67 mills per Kwhr. A comparison between revenue and costs is:

	Revenue		Costs	
	Present	Alternate	At 4.35%	At 5.7%
Total	$162,610	$190,487	$248,064	$266,371
Per Kwhr - Mills	8.40	9.84	12.81	13.76

The Alternate billing is under Schedule A-13S.

Under conditions of costs as incurred by the Power Division in providing the service to the Airport, both Present and Alternate revenues are viewed as too low.

In this instance however the A-13-S billing must be viewed as the ceiling rate and is the Schedule recommended for billing. The application of this tariff will provide an increase in billing of approximately $27,900, or 17.1%.

All Other Municipal Service - Balance:

This group is made up of miscellaneous Lighting and Power service to the many Municipal Departments and small accounts of the City and includes service to Police, Sheriff, Fire, Library, Purchasing, Public Works, Public Health, De Young Museum, Municipal Railway, Water, Schools, Recreation, War Memorial, Legion of Honor, Department of Electricity, Planning Commission, California Academy of Sciences, Log Cabin Ranch, Auditorium, Building Lighting, and Others.

This group, as a whole, accounts for approximately 9.2% of the System's adjusted sales and 17.3% of the revenue. Deliveries are at secondary voltage. In all, 821 accounts are involved, out of a total of 972 for Municipal - exclusive of service to traffic signals.

There are two groups served under flat rates, namely 20¢ for small power and 2.75¢ for miscellaneous lighting. In the first, there are 188 accounts and in the second, 295 or a total of 483 out of the 821 of this Municipal group. In revenues, the two flat billings represent but $72,820 for the year out of $694,224, or 10.4%.

The remaining Municipal accounts of this group provide nearly 90% of the revenue and are billed under block rate tariffs.

Both costs and alternate revenues have been computed for each of the sub-Municipal groups (Table 7 and Appendix C-4).

An over-all comparison of revenues and costs is:

	Revenue		Costs	
	Present	Alternate	At 4.35%	At 5.7%
Total	$694,224	$789,054	$885,215	$956,303
Per Kwhr	1.51¢	1.72¢	1.93¢	2.08¢
Percent Increase over Present		13.7%	27.5%	37.7%

The Alternate Schedules used are set forth in Appendix A-4-a along with the revenue calculations. It may be noted for the 2.0¢ flat charge, Schedule P-1-S has been used and, for the 2.75¢ charge, Schedule A-1-S. These two Schedules - as do the other Alternate tariffs used - correspond to those issued by the Public Utilities Commission of the City and County of San Francisco but are not now used for billing the City's loads. These Schedules are also identical to the present tariff schedules of the Pacific Gas and Electric of the same nomenclature, with the "S" deleted.

The costs developed carry the full production and transmission, plus the distribution - which latter provides for a Wheeling

Charge of 8.345 mills per Kwhr. The rates of return are as shown.

This Municipal group, as a whole, has relatively small hours of use for the kilowatts of demand imposed. Some of the service is not used regularly, resulting in a considerable monthly variation. The annual load factor is very low - 25%. With a low load factor, there is a high diversity - which is on the favorable side from point of view of system capacity required to serve the load.

The flat rate Small Power users would have the largest percentage increase - namely about 36%. Likewise, the customers now receiving the 2.75¢ charge would be raised 22%. There are a few other small groups that also have high increases. On the other hand, the largest group, made up of 81 accounts and covering a Combination Light and Power service under old Schedule C-1 (present revenue is $387,350), would realize an average increase of but 11.9%. Another fairly important group comprising 178 accounts, and where the present revenue is $125,610 and now billed under old L-1, would receive a 12.0% increase under Schedule A-1-S for General Lighting.

It is clear, from a cost-to-serve standpoint, a fairly large increase is warranted. It is believed, from a practical standpoint, that Alternate rates should not be exceeded. Such would result in but approximately half the percentage increase under the lower of the indicated costs to serve.

It is recommended that Alternate rate tariff billings replace Present (Appendix A-4-a) except for the following:

Schedule	Present	Recommended
Flat	2.0¢	2.5¢
Flat	2.75¢	3.0¢

The recommended Flat Charges can be viewed as interim rates covering a transition period.

There are other lesser accounts where the increase might be deemed to work a hardship, and a lower rate could be charged.

If it be deemed inadvisable to bring about Municipal rate increases, then attention is again called to the possibility of making the higher gross billing charges and showing a credit on the billing for the approximate amount of the increase. Thus, a record would be available as to savings realized.*

II - Irrigation District Load:

The rate charged and the billings made for delivery of Hetch Hetchy energy to the Districts are in accordance with the rate structure** contained in the contract (dated March 12, 1945 and as revised under date of June 1, 1953 - no charge in the rate) between the City and the Districts.

A comparison of the revenues and costs of providing the service is as follows:

	Revenues		Costs		
	Present (Contract)	Alternate (C.V.P.)	At 4.12%	At 4.35%	At 5.70%
Amount	$559,628	$618,400	$709,900	$728,800	$840,900
Per Kwhr - Mills	4.11	4.54	5.21	5.35	6.17
Per cent increase over Present		10.5%	26.8%	30.2%	50.2%

* If such a plan were followed, it could be urged that the savings referred to (in this case, $94,830 annually-Appendices A-4 and A-4a) are gross and should be charged with the loss in tax revenue that the City would receive if served by the Private Utility. If such tax was ½ of 1% of the gross revenues, in this case that would amount to $3,945 annually. Thus, the net savings would be about 96% of the gross, or $90,885. Where the Private Utility performs the "Wheeling" service, as in this case, and thus has the full plant investment, the City receives the full Ad Valorem Tax payment.

** Rate charged the Districts:
Demand Charge $0.85 per mo. per Kw of maximum demand
Energy Charge 2.2 Mills per Kwhr

The possible Alternate billing under the Central Valley's rate* is viewed as low, first from point of view of the City's own costs to serve the load, and secondarily, due to the fact that such deliveries are more or less hypothetical, as power deliveries from the Bureau are understood to be fully contracted for for some period in the future.

Looking at the rate from the City's indicated costs to provide the service, a substantially higher rate is justified. At the lowest cost, with a return of 4.12%**, an increase of over 26% is indicated.

The level of a rate to the Irrigation Districts must meet certain statutory requirements. Any review of the operating arrangements between the City and the Districts indicates the increasing mutuality of interests between the two. It would accordingly appear that it is to the interest of the Districts, as well as the City, that the operation and development of the Hetch Hetchy Project be kept in a sound and strong financial condition. This all points to the desirability of a negotiated revision in the present Contract, so as to provide the City with a needed increase in the present low rate now charged for the power service.

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* Alternate Rate:

Demand Charge — $0.75 per Kw of billing demand

Energy Charge

First	130	Kwhr per Kw of billing demand	4.0 mills per Kwhr
Next	130	" " " " " "	3.0 " " "
Excess	260	" " " " " "	2.0 " " "

Means of delivery to the Irrigation Districts is not known and the base C.V.P. rate is used.

** Based upon the weighted average effective interest rate of 4.12% for all bond issues up through September 21, 1950, in accordance with a

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For purposes of this study, a proposed rate* has been set up that would yield a gross revenue of approximately $697,690, and that represents an average revenue of $5.12 Mills per Kwhr, or an increase of 24.6%. This can be looked upon as a compromise rate proposal and is viewed as reasonable from both the Seller and Purchaser standpoint, at the present time.

III - Commercial Loads:

Riverbank Ordnance Plant:

In the United States Government owned plant at Riverbank, the contracting customer is Norris-Thermador Corporation.

Inasmuch as this Commercial customer is last in priority for Hetch Hetchy deliveries, a substantial part of the City's deliveries are Power purchases from Pacific Gas and Electric. For such Supplemental purchases, the City sells at the same rate as it buys under - namely for purchase - Schedule A-13 of Pacific Gas and Electric and Schedule A-13-S of the City's for sale. Previously - i.e., prior to

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(Continued from previous page):
study furnished by the Department and prepared by John F. Forbes & Company, Certified Public Accountants.

* Proposed Rate for Irrigation Districts:

Demand Charge:
$0.75 per Kw of Billing Demand

Energy Charge:

First	130	Kwhr per Kw of Billing Demand	- 4.0 Mills per Kwhr
Next	130	" " " " " "	- 3.50 " " "
Excess	260	" " " " " "	- 3.0 " " "

Billing Demand: the higher of (a) Maximum Demand; and (b) Sixty per cent of the previous highes maximum demand during the preceding eleven months.

November 10, 1952,* when the higher A-13 Schedules became effective, the C-6 Schedules prevailed.

The Riverbank Plant operations are at a comparatively low level. Under Chapter IV of Class Cost Allocations, the cost to deliver Project Power is shown to be higher than the revenue received. These same costs are also higher than Supplemental purchases. This is due to the low load factor of use. For the over-all comparative results, the following may be set down:

	Revenue	Cost	
	Present-Adjusted	At 4.35%	At 5.7%
Total	$140,673	$161,628	$172,379
Average rate - Mills	9.19	10.56	11.26
Costs higher than revenue		14.9%	22.5%

Under present conditions, the serving of this load cannot be viewed as particularly advantageous to the City. To the extent that Supplemental purchases are required, it has been pointed out that the costs of purchases and revenue received are a "wash", with no allowance for other incurred costs for handling the account.** To the extent that the load provides a market - under the Raker Act - for surplus Project Power deliveries, it serves a purpose. With growth in both Municipal and District's loads, such conditions are fast

* Effective date of increased electric rates of Pacific Gas and Electric Company under Decision No. 47832 of the California State Public Utilities Commission.

** The City does realize a slight saving in Hetch Hetchy line loss, - between Riverbank and Newark - as physically, Project Power is supplied to Riverbank and is replaced by a like amount of Supplemental purchases from Pacific Gas and Electric that are delivered to Newark for the City's Municipal use or sale to the other two Commercial loads.

[illegible]

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disappearing.

While the agreement between the City and Norris-Thermador provides for changes in rates under Public Utility regulation of the City, it also provides that the City must accord "- - - the lowest rate - - -" available for like conditions of service. As a practical matter, it is probable that the City could not charge more than the customer would pay if the service were purchased directly from Pacific Gas and Electric - in this case, as per Schedule A-13.

It is the recommendation that no change in the rate charged to the Riverbank Ordnance Plant be made.

Permanente Cement Plant:

Sales are made to this customer under an assigned contract* to the City by Pacific Gas and Electric as part of the Agreement between the City and the Utility for disposal of Hetch Hetchy power.

The assigned contract provides, among other things, that the "City shall follow the same billing and adjustment practices as are employed by Pacific Gas and Electric with respect to customers of like character, insofar as such practices are consistent with the fiscal procedure of City".

Therefore, under this agreement, Permanente Cement is charged the same rate by the City as if billed by Pacific Gas and Electric. The present effective Schedule is A-13-S, the same as

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* The original agreement was under date of April 18, 1945, and the supplemental agreement carrying the current effective rates providing for Supplemental power purchases by the City to make up any deficiencies it may have to supply the Cement load, is under date of November 19, 1952.

Pacific Gas and Electric's A-13.*

Reference to Chapter IV - both the text and Table 6 - shows that the Permanente Cement load is very profitable to serve (Also Table 7).

The revenue and cost results are:

	Revenue	Cost	
	Present - Adjusted	At 4.35%	At 5.7%
Amount	$1,103,530	$666,950	$794,691
Per Kwhr - Mills	7.87	5.24	5.84

Due to the very constant year around demands and high energy use (load factor 90% - also has a 98% power factor), the costs are low to serve. The City, with hydro-electric production and no fuel generated kilowatt hours, has a low Commodity, or kilowatt hour cost (exclusive of the Demand cost), that shows up favorably for customers with high load factors.

The purchase cost of Supplemental power for this load - which was only 10% by volume on the adjusted year basis - was also below the selling price - though materially higher than the cost of the City's own Project deliveries. This means in the future, as less Project power will be available for the Cement load and more Supplemental power will be purchased to supply it, it will still continue to be a profitable service - though necessarily less profitable than now.

The recommendation must necessarily be that the present

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* Prior to November 10, 1952, the effective rate was Schedule P-5. Adjustments from June 30, 1952 to November have been made to place the billing on a full year basis. A similar adjustment was made for Riverbank - both shown on Table A-4.

billing under Schedule A-13-S be continued, as it conforms to the Alternate rate and billing that would be made by Pacific Gas and Electric, if served by Pacific Gas and Electric under the assigned contract.

Kaiser Aluminum:

Kaiser Aluminum, as previously stated, is billed in accordance with an assigned contract (November 19, 1952) between Pacific Gas and Electric and the City, as per Supplemental Agreement between Pacific Gas and Electric and Kaiser Aluminum (dated April 28, 1952).

Service is subject to curtailment under stated conditions and in the same manner as would be imposed upon customers served by Pacific Gas and Electric under similar contract agreements. The rate* accorded is lower than for regular firm service.

Supplemental power purchases to meet the Kaiser Aluminum load, as stated in Chapter IV, are paid for at 3.6 mills per Kwhr and $0.30 per Kva month.

In the Adjusted 1952-53 year, the recorded sales for the 1953-54 year were used - due to the very sharp falling off in the Kaiser load.

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* Rate effective for Kaiser Aluminum:

Demand Charge:

First 1650	Kilovolt amperes or less of monthly maximum demand	-$1590.00
Next 1500	" " " " " " "	-$0.954 per Kilovolt-ampere
All Over 3150	" " " " " " "	-$0.848 per Kilovolt-ampere

Energy Charge: (to be added to Demand Charge)
3.84 Mills per Kilowatt hour at $1.90 fuel oil

The previous Chapter on costs shows the results developed. For uniformity of presentation, a summary comparison of revenues and costs are:

	Revenue Present-Adjusted	Cost At 4.35%
Amount	$52,441	$44,487
Per Kwhr - Mills	6.81	5.77

As practically all the deliveries to Kaiser Aluminum will come from Supplemental purchases, revenues will exceed costs by a substantial margin, as provided under the assigned contract.

As under the service to Permanente Cement, the City must charge the rate provided in the assigned contract, and it is therefore recommended that no change in those charges be made.

This completes the study, except for Summary Conclusions and Recommendations set forth in the last Chapter VI, that follows.

CHAPTER VI

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

CHAPTER VI

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

Chapter I - Introduction:

The primary objectives of the study - namely, to determine the costs associated with the operation of the Power Division and the rates and charges that may reasonably be made for that service - have, it is submitted, been quite fully analyzed and developed. These will, in this last Chapter, be summarized in over-all perspective for review.

The present Hetch Hetchy Plant for both Water and Power, as now built as to investment; costs of operation; and in the manner it now functions; has been taken as the standard from which the analysis has been made.

The statutory requirements as contained in the Raker Act and the operating agreements for disposal of Project Power, as well as the purchase of Supplemental Power, necessarily have been taken cognizance of and are reflected in the results and recommendations.

Chapter II - Cost Separation of Water and Power Functions:

This Chapter has had for its purpose the determination of the plant investment and annual costs of operation as between the Water and Power functions. Such was necessary in order to proceed with the principal objectives of this study - namely, the allocation of Power Division Costs as between each of the classes served and the analysis of the rate structure for each of said Power classes.

The results achieved are viewed as economically sound and reasonable.

In utilizing the "direct allocation" approach for the major

portion of investments and annual costs to be separated, recognition is given to the manner in which the plant facilities are used and operated, and the functions performed.

For the remaining portion, where the use concept is not susceptible to the physical concepts of cost allocations but wherein the value of the service must be appraised in terms of economic benefits resulting from the over-all operation of the Project, the River Basin method of Separation provides a reasonable means of analysis.

The results are interpreted to show, in both this and Chapter III on Earnings, that the Water Supply Division is the marginal service, and that in a multiple purpose Project, the individual functions must share in the burdens and benefits of the Project as a whole; and further, no one function can be assigned greater cost burdens than the resulting end benefits. Such are the basic tenets of the River Basin theory of cost separation.

Chapter III - Earning Position:

The earning position of the Department, wherein the investment and cost separations developed in Chapter II, in conjunction with the revenues from the same Chapter, provides the following rates of return:

Power	Water	System
4.35%	3.76%	3.97%

The 3.97% is at the approximate level of the cost of bond money realized by the Project. The weighted average cost of bond money from its inception is given as 4.12%.

The study further shows that the 4.35% return for Power

would rise to 6.12% if it be assumed the present Pacific Gas and Electric rates be substituted for those now charged by the City - except for the deliveries to the Irrigation Districts. In reference to the latter, a very favorable Central Valley's Power rate is used.

Increases in the rates charged to yield higher rates of earnings would call for the following increases in gross revenue:

INCREASES IN GROSS REVENUES

To Yield A Return Of	Power Amount	Power %	Water Amount	Water %	System Amount	System %
4.5	$ 46,760	1.2	$ 428,180	12.1	$ 474,940	6.3
5.0	201,930	5.1	716,980	20.2	918,910	12.2
5.5	357,090	9.0	1,005,780	28.4	1,362,870	18.1
5.7	419,160	10.5	1,121,300	31.6	1,540,440	20.5
6.0	512,260	12.9	1,294,580	36.5	1,806,840	24.0
6.12	556,470	14.0	-	-	-	-

It is further noted that the costs developed do not provide for bond redemption, but only for depreciation, insofar as plant write-off is involved. However - as a practical matter - to the extent depreciation is accrued ahead of plant retirements - there is an amount from this source that is currently available and is used for bond redemption.

Chapter IV - Cost Allocation To The Classes:

The summary results are set forth in Table 7 and need not again be brought forward in detail. However, the following observations may be noted:

I - San Francisco Municipal Loads:

Railways	Present revenues are fairly close to costs-slightly under.
Street Lighting and Traffic Signals	Revenues are somewhat over costs at 4.35% return, and under at 5.7% return.
Crystal Springs Pumps	Revenues are substantially over costs - a favorable load to serve.

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[illegible]

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[illegible]

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All Other Municipal:	
Airport	Revenues are sharply under costs.
Balance	Revenues are sharply under costs.
Municipal Loads in Total	Revenues are substantially under indicated costs.

Under each sub-class and for the service as a whole, present City revenues are under those that would be realized if Pacific Gas and Electric rates be established. The increases that would result are developed as approximately $498,000, or 22.9% (Appendix A-4).

II - Irrigation District Load:

The present average revenue of 4.11 mills per Kwhr compares with indicated costs of 5.35 mills and 6.17 mills at 4.35% and 5.7% returns respectively. An alternate rate of 4.54 mills, or an increase of 10.5%, is also developed from an application of an equivalent Central Valley rate.

III - Commercial Loads:

Riverbank Ordnance Plant:

Costs developed are somewhat higher than revenues. With the necessity to supply this load essentially from Supplemental power purchases, and with such purchase costs at the same level as the sales rate, there is no financial advantage rate wise in making the power delivery. The City's own cost of Project Power deliveries, at present low load factor of use, is higher than revenues received.

Permanente Cement Plant:

A very favorable Commercial load to supply, with a high annual load factor. Revenues are substantially higher than indicated costs.

Kaiser Aluminum:

This service - while treated as a credit to the Power

Division's operations, due to its interruptible feature for power supplied from Supplemental purchases - is a favorable load to serve. Costs, on an incremental basis, are lower than revenues and full costs from Supplemental purchases are also lower than revenues received. Unfortunately, the magnitude of use has dropped sharply so dollar-wise the load is relatively unimportant at present levels of operations.

Chapter V - Rate Analysis:

In this final section on Conclusions and Recommendations, which deals with rates, a summary dollar tabulation under present and proposed rates will first be given and then briefly discussed. The tabulation is as follows:

Classification	Revenues Present	Revenues Recommended	% Increase	Rate
I - San Francisco Municipal:				
Railway	$710,252	$ 710,252	-	Present
Street Lighting	448,994	501,001	11.6	Change Metered
Traffic Signals	40,100	40,559	1.1	Change
Crystal Springs Pumps	113,537	102,500	(9.7)	Change
Other Municipal:				
Airport	162,610	190,487	17.1	Change
Balance	694,224	780,270	12.4	Change
Total Municipal	$2,169,717	$2,292,149	5.6	
II - Irrigation Districts:				
Total	$559,628	$697,690	24.7	Change

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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Classification	Revenues Present	Recommended	% Increase	Rate
III - Commercial Loads - Firm:				
Riverbank Ordnance	$ 140,673	$ 140,673	-	Present
Permanente Cement	1,103,530	1,103,530	-	Present
Total	$1,244,203	$1,244,203	-	
IV - Total Classes I, II & III	$3,973,548	$4,266,962	7.4	

Under "Recommended", the amounts recorded follow the text in Chapter V. For Street Lighting, the present charge of 1.345¢ per Kwhr is replaced with 1.400¢; and the small miscellaneous sales at the Airport are placed under Alternate rates. The 1.400¢ corresponds to the City's cost at a 5.7% return. The Alternate billing under the Public Utilities Commission published tariff LS-5-S is 1.800¢, or 28.5% higher. Having in mind the civic nature of Municipal Street Lighting, the 1.400¢ charge per kilowatt hour for deliveries from the Power Division to the City is viewed as a fair charge. If any actual increase is not made, but only an accounting, then the full Alternate rate of 1.800¢ is recommended.

Traffic signal charges for the unmetered service are left unchanged. The small amount that is metered is placed under Schedule A-1-S.

In the case of Crystal Springs Pumps, the modified P-30 rate is recommended, as set forth in the Rate Chapter. This treatment accords recognition to the favorable costs of providing the service and gives a reduction of 9.7%. Such billing is lower than would result from A-13-S by 13.5%, but is higher than the indicated costs by 6.1%, under a 5.7%

return.

Airport revenues are viewed as distinctly low and the present C-6 rate as entirely inadequate. In this case, costs to serve are substantially higher than the A-13-S Alternate billing, with a 4% discount for primary voltage delivery. As the analysis shows, a substantial part of the revenues are required to pay the Wheeling Charge. However, the A-13-S Schedule is viewed as the proper tariff to apply and is recommended. Power Division billing could not be higher than are available from Pacific Gas and Electric under the same A-13 rate tariff.

For the Balance of Municipal services covering the many City Departments and related Municipal deliveries, Alternate rate tariffs, as issued by the Public Utilities Commission and Bureau of Light, Heat and Power are recommended, except for the two flat rate services of 2.75¢ and 2.0¢, wherein 3.0¢ and 2.5¢ are proposed. This latter step is taken in order to lessen the increase at this time. As heretofore mentioned, a few of the lesser billings carry fairly large percentage increases that could be modified.

The proposed rates provide an over-all increase of but 5.7%, or approximately $122,400 for all of the Municipal services.

For the two Irrigation Districts, a new proposed rate is recommended (as per text under Rates) that will yield 5.12 mills per Kwhr, as compared to the present very low rate of 4.11 mills for Firm Power deliveries. The resulting increase would be approximately 24.7% and in round figures, $138,000 annually, at the level of purchases for the period studied.

The level of rate recommended is viewed as most favorable for wholesale Power deliveries of the type supplied.

The present contract rates for the Commercial loads are recommended. While the rate to Riverbank Ordnance Plant does not return a profitable earning, it is part of the over-all contract agreement for the disposal of Project Power and probably should not be disturbed, as sales are on the A-13-S Schedule.

The present charges for the remaining two assigned loads provide favorable earnings - especially the large delivery to Permanente Cement. These are contract rates and are tied into similar deliveries on the Pacific Gas and Electric system, and the provisions of the assigned contracts do not lend themselves to changes and none are deemed warranted.

Under the level of rates suggested, the Power Division rate of earnings would approximate 5.1%. If no Municipal increases were made, the return would drop to 4.8% and, of the Municipal increases, if only that to the Airport were realized, then the return would be slightly under 4.9%.

Conclusion:

In final conclusion, it is believed that the many phases of this study's development have been analyzed in a comprehensive manner; that the objectives have been met and obtained; and that the results developed are both practical and reasonable and that the recommendations warrant careful consideration.

A-P-P-E-N-D-I-X

HETCH HETCHY WATER AND POWER DIVISION SEPARATION STUDY

AND

POWER DIVISION COST AND RATE ANALYSIS

A-P-P-E-N-D-I-X A

C-O-P-Y

DEPARTMENT OF THE INTERIOR
INFORMATION SERVICE

JOINT RELEASE --- INTERIOR-ARMY ENGINEERS

April 6, 1954

THREE AGENCIES REACH AGREEMENT ON COST ALLOCATION

An agreement on a system of allocation of costs of multiple-purpose water resource projects has been reached by the Department of the Interior, the Department of the Army for the Corps of Engineers, and the Federal Power Commission.

The costs of dams and other joint facilities will hereafter be allocated so that all of the purposes of the project, such as flood control, navigation, recreation, power production, irrigation and water supply, will share equitably in the reduced cost resulting from a joint development.

The allocation of costs for a multiple-purpose hydroproject is basically not complicated. In the first place, the items of cost which are clearly for one purpose only are allocated to that purpose. For example, the costs of generators, turbines, and switch gear which have to do only with the generation of power are specifically and wholly allocated to power. The costs of navigation locks are allocated to navigation. The costs of pumps and irrigation canals are allocated to irrigation.

There remain certain features of a multiple-purpose project which are not clearly for a single purpose, such as the main dam itself, the cost of right-of-way for the reservoir, the cost of service roads and maintenance personnel housing. It is the allocation of the costs of these common or joint facilities that is somewhat involved and must be carefully arrived at so that each of the functions of the project are fairly charged with their respective shares.

In the past, several methods of cost allocations have been used by the three agencies. As an illustration, the cost allocations on Bonneville dam, Grand Coulee, Hoover Dam, and Fort Peck were reached by the use of different methods. Under the new agreement a uniform method will be applied to all projects.

The new system corrects the unsatisfactory circumstances where three Federal departments frequently arrived at three different answers to the same question.

The agreement contains the recommendations made on the basis of studies by the previous administration. It conforms to a directive of the Bureau of the Budget issued December 31, 1952, which stated: "It has been generally recognized that the absence of a clear statement of uniform standards and procedures has resulted in delays and difficulties in the clearance of project reports."

A congressional subcommittee, in a report of the House Committee on Public Works, dated December 5, 1952, recommended "that all costs of a water resource development project be allocated so that each authorized purpose of the project will bear its own share of these costs and share equitably in economies or savings resulting from the use of a multiple-purpose development".

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C-O-P-Y

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There remain certain features of a multiple-purpose project which are not clearly for a single purpose, such as the main dam itself, the cost of right-of-way for the reservoir, the cost of service roads and maintenance personnel housing. It is the allocation of the costs of these common or joint facilities that is somewhat involved and must be carefully arrived at so that each of the functions of the project are fairly charged with their respective shares.

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The new procedure is essentially the same as that recommended in 1950 by an interagency group representing the Corps of Engineers, Federal Power Commission, and the Departments of Agriculture, Interior, and Commerce.

Multiple-purpose projects are found generally feasible for development only when each of the purposes bears a fair share of the cost of the dam, reservoir or other joint features. The new agreement offers a fair basis for sharing these costs among the several purposes to be served, so that the maximum usefulness can be obtained for the least cost.

Rates for the sale of power from multiple-purpose projects are based on the costs allocated to power production. Generally speaking, the higher the costs allocation to power the higher the rates; conversely, the lower the cost allocation to power, the lower the rates.

Each of the agencies involved in the new agreement has a direct responsibility in Federal water resource development, such as Interior is the marketing agency for power generated at dams built both by the Army Engineers and the Reclamation Bureau. The Federal Power Commission approves the rates for power from these projects.

The agencies agreed that, as a minimum, each purpose or function should be charged with the cost added solely because of its inclusion in the multiple-purpose project. It was agreed also that the legislative background and justifying reports of authorized projects should be considered in making the allocation.

Of the several possible methods of allocating the cost, the Separable Costs-Remaining Benefits Method is considered preferable. The Alternative Justifiable Expenditure Method is also considered acceptable where only limited information is available and the expense of obtaining additional data is not warranted. The Use of Facilities Method, a third method, is considered acceptable where the use which is made of the dam and other joint features by the various functions of the project can be measured on a comparable basis, and where use of this method would be consistent with the basis of project formulation and authorization.

The first two methods distribute joint project costs to the various functions in proportion to the cost of providing for these functions by a reasonable alternative means, but limited by the value of the benefits produced by each. The third method allocates joint costs in proportion to the use which is made of the joint features by the several functions of the development, where this may be determined.

Copy of the detailed statement on cost allocation is attached.

x x x

Cost Allocation

Costs of a multiple-purpose project shall be allocated among the purposes served in such a manner that each purpose will share equitably in the savings resulting from combining the purposes in a multiple-purpose development.

Acceptable Methods (See attachment for brief descriptions)

(1) Separable Costs-Remaining Benefits Method.
This method is considered preferable for general application.

(2) Alternative Justifiable Expenditure Method.
This method differs from (1) only in employing specific costs of the various functions rather than their separable costs. It is acceptable where the necessary basic data to determine separable costs are not available and the time and expense required to obtain the data are not warranted.

(3) Use of Facilities Method.
This method is acceptable where the use of facilities is clearly determinable on a comparable basis and where use of this method would be consistent with the basis of project formulation and authorization.

Minimum Allocation

Each purpose shall be allocated, in every case, at least its separable cost (the cost traceable to its inclusion in a multiple-purpose project). Limitations of basic data may occasionally require the use of specific cost (the cost of features identified solely with a single purpose) and other available data as constituting the best available basis for approximating separable costs.

Legislative History

The legislative history of authorized projects shall be considered in the allocation of cost. The authorizing act, committee reports, project justification documents, and similar sources disclose the nature of the proposal submitted to the Congress and of congressional action thereupon.

Consideration of Economic Costs

In applying any one of the above allocation methods, taxes in an amount equal to those which would be foregone as a result of Federal development of the power rather than the most likely alternative development shall be included as an economic cost when distributing costs among the project purposes for analysis of economic justification, but shall be subtracted from the costs thus distributed to power in order to obtain the allocation of project costs to power.

Value of Power

The value of power produced means the estimated market value which would be obtainable if it were to be sold on an open competitive basis, without restriction as to the use or resale. The value of power shall be determined as the lower of two figures:

(1) The estimated actual cost of equivalent power from the most likely alternative source that would be expected to develop in the absence of the project, to meet the same power needs, with appropriate adjustment for transmission costs and losses and other technical factors.

(2) Estimated value of power to users. (Applicable where costs of alternative power would be prohibitive either for part or all of the power produced.)

The value of power, determined as indicated above, shall be used for computations of economic benefits in project justification and for the allocation of project costs. It will not be used to establish the level of power revenues, which are based on the amortization of project costs (Federal power investment) over a reasonable period of years.

Project Feasibility

Criteria of project feasibility shall be such that, insofar as can be determined in advance:

(1) Projects will be considered economically feasible when the value of power (as defined above) will at least equal the project costs allocated to power, plus the amount of taxes which would be foregone as a result of Federal development of the power rather than the most likely alternative development.

(2) Projects will be financially feasible, i.e., they will have potential net revenues from power sales sufficient to reimburse the Federal Government for the Federal investment in power.

Brief Description of Methods of Cost Allocation

The Separable Costs-Remaining Benefits Method has the following steps:

(1) The benefits of each purpose are estimated.
(2) The alternate costs of single-purpose projects to obtain the same benefits are estimated.
(3) The separable cost of each purpose is estimated.
(4) The separable cost of each purpose in the multiple-purpose project is deducted from the lesser of each purpose's benefits or alternate cost. The lesser figure is used since alternate cost is used in this method only if it represents a justifiable expenditure, that is, if it does not exceed the benefits.
(5) From total cost of project deduct all separable costs to determine residual costs.
(6) Residual costs, designated as joint costs in this method, are distributed in direct proportion to the remainders found in step 4.
(7) To determine the cost allocated to each purpose, add the separable and distributed costs for each purpose and, in the case of power, subtract from that sum the amount of taxes foregone which was used in computing power costs under steps 2 and 3 above.

The Alternative Justifiable Expenditure Method has the following steps:

(1) The benefits of each purpose are estimated.
(2) The alternate costs of single-purpose projects to obtain the same benefits are estimated.
(3) The specific cost of each purpose is determined.
(4) The specific cost of each purpose in the multiple-purpose project is deducted from the lesser of that purpose's benefits or alternate cost. The lesser figure is used since alternate cost is used in this method only if it represents a justifiable expenditure, that is, if it does not exceed the benefits.
(5) From total cost of project deduct all special costs to determine joint costs.
(6) Joint costs of the multiple-purpose project are distributed among purposes in direct proportion to the remainders found in step 4.
(7) Allocation of project cost is determined in the same manner as under the separable costs-remaining benefits method.

The Use of Facilities Method has the following steps:

(1) The use which is made by each purpose of joint project facilities is estimated on some basis which is comparable for the purposes concerned, using such measures of use as those of flow, reservoir capacity, energy consumption, and others as may be applicable.
(2) The separable cost of each purpose is estimated. (In cases of minor importance specific rather than separable costs mey be used.)
(3) From total cost of project deduct all separable costs to determine joint (residual) costs.
(4) Joint costs of the multiple-purpose project are distributed among purposes in proportion to the comparable measures of use of the joint facilities estimated in (1).
(5) To determine the cost allocated to each purpose, add the separable and distributed costs for each purpose and, in the case of power, subtract from that sum the amount of taxes foregone which was used in computing power cost under (2) above.

ANNUAL EXPENSES OF OPERATION
SPECIFIC EXPENSE ASSIGNMENTS

In Appendix A-2, tabulations and operating expenses have been specifically assigned and allocated as between the Divisions of Power and Water, with a part of such expenses allocated to Joint.

The basis of the allocations is that resulting from an understanding of what the purpose of the expenditure is, the function of the activity performed, and the time spent as between the two Divisions. Where the expenditure was for a more indirect use, such as for maintenance of roads and trails; the operation of boarding houses; and snow and water gauging under hydrography; the expenses involved were assigned in total to the "Joint" classification. The amounts so accumulated were later allocated between the two Divisions, in accordance with the over-all allocation percentages developed under the River Basin analysis. The latter results are set forth in Appendix B.

In making the specific assignments described, the following principal steps were taken:

1 - A detailed accounting analysis was made of each of the accounts and sub-accounts where any possibility existed as to a common or joint use. The month of August 1952 was selected, with some further analysis of other months, including that of May 1953.

In this analysis, charges were first broken down as between payroll and miscellaneous. Each of these were further analyzed. Payroll, which was by far the major portion of the expenses, was broken down by employees, noting the names of

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each, the job classification and the particular work performed, if given. Miscellaneous expenses were analyzed, where necessary, showing whether for material or for payment for utility services, or other special services.

In the case of Automotive expenses, the analysis showed the car, and generally the purpose for which the car was used.

Depreciation expense was taken from the detail Capital Analysis presented in Appendix A-3.

2 - From an organization chart, where the Supervisory and Operating personnel is set forth by individual names, a fairly complete understanding of the manner of operation was obtained. From the job analysis under Item 1, and the organizational set-up, a helpful co-ordination of how the personnel's time was divided between Water and Power was acquired.

3 - An on-the-ground field analysis was made. Plant operations were reviewed and the views of Supervisory personnel were obtained as to the division in their time between functions.

4 - Based upon the above analysis, combined with judgement, expense allocations - as set forth in Appendix A-2 - were made.

Expense adjustments, from recorded amounts, were made for purchase of supplemental power and for wheeling charges paid to Pacific Gas and Electric Company.

The large reduction in the first item was brought about due to a normalization of the sales to the Kaiser Aluminum plant since June 30, 1953. Practically all such sales are purchased.

The normalization in the wheeling charges relates to a supplemental agreement wherein the charges for the energy transported to San Francisco International Airport were reduced.

Detail as to the changes made in these two items will be developed under the next Section of the report on "Cost Allocations to the Classes".

The Bureau of Light, Heat and Power performs many of the functions similar to those of a Commercial Department of a Utility. Its charges, while not a part of the Hetch Hetchy Project as charged, have been added in the amount of 14,000 dollars to the Power Division expense.

SUMMARY OF ANNUAL EXPENSES OF OPERATION WITH SEPARATION AS BETWEEN POWER, WATER AND JOINT HETCH HETCHY POWER AND WATER SUPPLY ADJUSTED YEAR ENDING - JUNE 30, 1953

Classification	Power %	Power Amount $	Water %	Water Amount $	Joint %	Joint Amount	Total Amount $
Production							
Acct. Operation							
715 Supervision & Engineering	80	34,870	20	8,718			43,588
716 Station Labor							
.1 Hydraulic	80	28,103	20	7,026			35,129
.2 Prime Movers & Generators	100	39,823	-				39,823
.3 Electric	100	32,012	-				32,012
.4 Miscellaneous	90	6,116	10	680			6,796
Total Acct. 716		106,054		7,706			113,760
718 Supplies & Expenses							
.1 Lubricants	100	110					110
.2 Station Supplies	100	1,110					1,110
.3 Station Expense	70	28,800	30	12,344			41,144
.4 Hydrography					100	14,978	14,978
.5 Moccasin Club House Meals					100	19,972	19,972
.6 Other Boarding House Meals					100	17,945	17,945
Total Acct. 718		30,020		12,344		52,895	95,259
Acct. Maintenance							
719 Supervision & Engineering	50	7,205	50	7,205			14,410
720 Structures	80	36,550	20	9,137			45,687
721 Reservoirs Dams & Water way							
.1 Forebays, Penstocks & Jailraces	100	1,846	-				1,846
.2 Intake Power House Waterways	100	4,802	-				4,802
.3 Reservoirs, Dams & Waterways					100	6,614	6,614
Total Acct. 721		6,648				6,614	13,262
722 Generating & Elec. Equipt.							
.1 Prime Movers	100	7,968					7,968
.2 Accessory Elec. Equipt.	100	2,449					2,449
.3 Miscel. Power Plant Equipt.	75	15,062	25	5,021			20,083
Total Acct. 722		25,479		5,021			30,500
723 Roads & Trails							
.1 Roads & Trails					100	44,232	44,232
.2 Automotive Equipt.					100	21,009	21,009
.3 Telephone Lines					100	4,962	4,962
.4 Radio Equipt.					100	2,390	2,390
Subtotal						72,593	72,593
.7 Vacation	72	4,895	28	1,903			6,798
.8 Sick Pay	72	3,087	28	1,201			4,288
Total Acct. 723		7,982		3,104		72,593	83,679
738 Purchase Power	100	252,646					252,646
Total Production Expense		507,454		53,235		132,102	692,791

SUMMARY OF ANNUAL EXPENSES OF OPERATION WITH SEPARATION AS BETWEEN POWER, WATER AND JOINT HETCH HETCHY POWER AND WATER SUPPLY ADJUSTED YEAR ENDING - JUNE 30, 1953

Classification	Power %	Power Amount $	Water %	Water Amount $	Joint %	Joint Amount $	Total Amount $
Transmission							
Acct. Operation							
743 Supervision & Engineering	40	6,070	60	9,105			15,175
745 Operation of Stations							
0.1 Station Labor	100	36,622					36,622
0.2 Station Supplies & Expenses	100	3,106					3,106
Total Acct. 745		39,728					39,728
746 Operation of Lines							
.1 Overhead Lines		-		-		-	-
.2 Reservoirs, Dams & Waterways			100	1,812			1,812
.3 Wells & Springs			100	5,163			5,163
.4 Rock River Lime Plant			100	4,789			4,789
.5 Tesla Portal Plant			100	5,732			5,732
Total Acct. 746				17,496			17,496
Maintenance							
747 Supervision & Engineering	45	7,198	55	8,797			15,995
748 Structures & Improvements	45	1,095	55	1,339			2,434
749 Station Equipment	85	1,460	15	258			1,718
750 Overhead System							
.1 Towers & Fixtures	100	62					62
.2 Poles & Fixtures	100	21,590					21,590
.3 Conductors & Devices	100	71,319					71,319
Total Acct. 750		92,971					92,971
751 Waterways (San Joaquin Valley)							
.1 Pipe Lines			100	12,012			12,012
.2 Tunnels			100	5,374			5,374
Total Acct. 751				17,386			17,386
752 Roads & Trails							
.1 Roads & Trails					100	8,015	8,015
.2 Automotive					100	18,116	18,116
.3 Telephone Lines					100	37	37
.4 Radio					100	2,526	2,526
.5 Rock River Lime Plant			100	136			136
.6 Tesla Portal Plant			100	1,135			1,135
Subtotal				1,271		28,694	29,965
.7 Vacation Pay - Maintenance Crew	87	6,545	13	978			7,523
.8 Sick Leave - Maintenance Crew	87	4,472	13	668			5,140
Total Acct. 752		11,017		2,917		28,694	42,628
753 Miscellaneous Rents	100	54,000					54,000
Total Transmission		213,539		57,298		28,694	299,531

SUMMARY OF ANNUAL EXPENSES OF OPERATION
WITH SEPARATION AS BETWEEN POWER, WATER AND JOINT
HETCH HETCHY POWER AND WATER SUPPLY
ADJUSTED YEAR ENDING - JUNE 30, 1953

Classification	Power %	Power Amount $	Water %	Water Amount $	Joint %	Joint Amount $	Total Amount $
Distribution							
756 Supervision & Engineering	50	196	50	195			391
776 Rents & Wheeling Charges	100	949,977					949,977
Total Distribution							
Commercial*							
Total	100	14,000					14,000
Administrative & General							
Total	75	263,470	25	87,823			351,293
Depreciation							
Total		250,216		1,042,375		417,748	1,710,339
Taxes							
Property		8,220		12,020			20,240
Fee Paid Federal Government						30,000	30,000
Total Expenses-Adjusted Year		2,207,072		1,252,946		608,544	4,068,562
Adjustments made							
Purchase Power							
Recorded $776,338							
Adjusted 252,646							
Reduction		523,692					523,692
Wheeling Charge							
Recorded 982,383							
Adjusted 949,977							
Reduction		32,406					32,406
Total Adjustment		556,098					556,098
Total Expenses - Recorded Basis		2,763,170		1,252,946		608,544	4,624,660

* Not recorded as a Hetch Hetcht Expense

PLANT CAPITAL
SPECIFIC CAPITAL ASSIGNMENTS

In this Appendix, Capital, Reserve for Depreciation, and Depreciation Expense are separated as between Water and Power supply and also "Joint". These are viewed as specific assignments without allocations and will now be briefly reviewed.

Assignment of Capital Classified as Water Supply on the Books:

Appendix A-3-a summarises the average Capital, Reserve for Depreciation and Depreciation Expense for the fiscal year ending June 30, 1953, for the Water Supply Division. Appendix A-3-b similarly treats the Power Division.

All dollar amounts are in the first instance taken from the plant ledgers and other basic records of the Hetch Hetchy Project at 425 Mason Street, San Francisco.

At five-year intervals, a "Historical Cost Appraisal" is made of the recorded plant investment and depreciation reserve. Such a study was made as of June 30, 1953, by the John F. Forbes & Company, independent Certified Public Accountants. The results of this work, along with specific requested breakdown of plant investment, reserve, and depreciation expense figures were made available and formed the basis of all capital figures and depreciation accrual amounts used in this study. These amounts were available for each of the Power and Water Supply Divisions by accounts and with certain further breakdowns, as requested. All allocations and separations as between Power, Water and Joint are solely the result of this study. A brief statement and explanation will now be made covering some of the more important elements of the assignments made.

FIXED CAPITAL, DEPRECIATION RESERVE AND DEPRECIATION EXPENSE
HETCH HETCHY WATER SUPPLY DIVISION
Fiscal Year Ended June 30, 1953
(In Dollars)

Item	Average Plant Capital				Average Reserve for Depreciation				Depreciation Expense			
	Water (1)	Power (2)	Joint (3)	Total (4)	Water (5)	Power (6)	Joint (7)	Total (8)	Water (9)	Power (10)	Joint (11)	Total (12)
I - Intangible Plant Capital												
C-2 Franchise & Water Rights			2,735,630	2,735,630				-				-
C 5 Landed Capital												
5-A Source of Water Supply			128,683	128,683				-				-
5-D Right of way	414,337	189,090	-	603,427				-				-
5-E General office			70,060	70,060								
5-F Roads, trails -	191,308	619,928	165,186	976,422		63,269	1,489	64,758		891	556	1,447
Total C-5	605,645	809,018	363,929	1,778,592		63,269	1,489	64,758		891	556	1,447
C-6 Buildings - Structures & Grounds												
6-A Source of watter supply	4,174	261,583	86,323	352,080	1,452	36,696	48,962	87,110	92	4,017	2,329	6,438
6-B Pumping Station	11,014			11,014	4,819			4,819	275			275
6-C Purification	49,797			49,797	9,427			9,427	1,500			1,500
6-D General Office & other			11,572	11,572			3,408	3,408			1,083	1,083
Total C-6	64,985	261,583	97,895	424,473	15,698	36,696	52,370	104,764	1,867	4,017	3,412	9,296
C-7 Impounding Dams and Reservoirs												
Hetch Hetchy Division												
O'Shaughnessy Dam (1923)			10,585,295	10,585,295			1,852,427	1,852,427			105,853	105,853
Other			938,859	938,859			333,145	333,145			18,942	18,942
O'Shaughnessy Dam (1939)*			4,226,294	4,226,294			594,322	594,322			44,024	44,024
Other			317,403	317,403			13,731	13,731			3,763	3,763
Total			16,067,851	16,067,851			2,793,625	2,793,625			172,582	172,582
Lake Eleanor Division												
Total		571,147		571,147		199,885		199,885		11,513		11,513
Total C-7		571,147	16,067,851	16,638,998		199,885	2,793,625	2,993,510		11,513	172,582	184,095
C-8 Lake and River Cribs												
Early Intake Division			733,605	733,605			128,381	128,381			7,336	7,336
Lower Cherry Division		37,940		37,940		12,452		12,452		1,045		1,045
Total C-8		37,940	733,605	771,545		12,452	128,381	140,833		1,045	7,336	8,381
C-13 Canals and Conduits												
Mountain Division			15,369,918	15,369,918			3,209,393	3,209,393			183,135	183,135
Lower Cherry Division		619,604		619,604		512,063		512,063		14,305		14,305
Balance	66,001,758			66,001,758	15,235,590			15,235,590	1,030,268			1,030,268
Total C-13	66,001,758	619,604	15,369,918	81,991,280	15,235,590	512,063	3,209,393	18,957,046	1,030,268	14,305	183,135	1,227,708
C-16 Purification	37,260			37,260	22,773			22,773	1,569			1,569
C-24 General Equipment			341,773	341,773			214,144	214,144			23,835	23,835
C-26-G Undistributed			23,609	23,609			-					-
Total -Water Supply Division	$66,709,648	2,299,292	35,734,210	104,743,150	15,274,061	824,365	6,399,402	22,497,828	1,033,704	31,771	390,856	1,456,311
Total -Power Supply Division	417,543	11,559,278	1,157,677	13,134,498	157,734	6,275,300	550,114	6,983,148	8,671	218,445	26,892	254,008
Total -Hetch Hetchy System	$67,127,191	13,858,570	36,891,887	117,877,648	15,431,795	7,099,665	6,949,516	29,480,976	1,042,375	250,216	417,748	1,710,339

* Federal Contribution of $1,100,000 in the raising of O'Shaughnessy Dam through the Public Works Administration is considered off-set by operating donations of the project and is not deducted from this net plant capital.

Appendix A-3b

FIXED CAPITAL, DEPRECIATION RESERVE AND DEPRECIATION EXPENSE
HETCH HETCHY POWER DIVISION
Fiscal Year Ended June 30, 1953
(In Dollars)

	Average Plant Capital				Average Reserve for Depreciation				Depreciation Expense			
	Water (1)	Power (2)	Joint (3)	Total (4)	Water (5)	Power (6)	Joint (7)	Total (8)	Water (9)	Power (10)	Joint (11)	Total (12)
I - Intangible Plant Capital												
301 - Organization												
302 - Franchises and Consents												
II - Production Plant-Hydraulic												
320 - Land and land rights		53,903		53,903				-				-
321 - Structures and improvements		886,374		886,374		415,354		415,354		13,408		13,408
322 - Reservoirs, dams & water ways	417,543	5,899,086	483,529	6,800,158	157,734	2,866,950	148,171	3,172,855	8,671	104,937	6,557	120,165
323 - Water Wheels, turbines & generators		1,180,948		1,180,948		641,238		641,238		35,335		35,335
324 - Accessory electric equipment		187,193		187,193		127,167		127,167		4,701		4,701
325 - Miscellaneous power plant		21,627		21,627		18,406		18,406		570		570
326 - Roads, railroads, and bridges		20,728		20,728		641		641		11		11
Total	417,543	8,249,859	483,529	9,150,931	157,734	4,069,756	148,171	4,375,661	8,671	158,962	6,557	174,190
III - Transmission Plant												
340 - Land and land rights		50,300		50,300				-				-
341 - Clearing lands and right of way		38,212		38,212				-				-
342 - Structures and improvements		102,892		102,892		22,138		22,138		2,556		2,556
343 - Station equipment		629,977		629,977		418,535		418,535		18,389		18,389
344 - Towers and Fixtures		871,432		871,432		587,073		587,073		21,348		21,348
345 - Poles and fixtures		38,551		38,551		38,551		38,551		-		-
346 - Overhead conductors & devices		1,086,165		1,086,165		957,885		957,885		3,747		3,747
347 - Underground circuit		693		693		693		693		-		-
348 - Underground conductors & devices		1,176		1,176		1,058		1,058				-
Total		2,819,398		2,819,398		2,025,933		2,025,933		46,040		46,040
IV - General Plant												
370 - Land and land rights		1,128		1,128				-				-
371 - Structures and improvements		214,120	615,805	829,925		134,070	385,587	519,657		[illegible],090	17,534	23,624
372 - Office furniture & equipment		4,917		4,917		3,387		3,387		107		107
373 - Transportation equipment		21,952		21,952		13,063		13,063		1,599		1,599
375 - Shop equipment		72,647		72,647		25,301		25,301		2,990		2,990
376 - Tools and work equipment		5,033		5,033		3,790		3,790		127		127
378 - Communication equipment		63,239	33,205	96,444		-	2,036	2,036		2,530	1,527	4,057
379 - Miscellaneous equipment			25,138	25,138			14,320	14,320			1,274	1,274
395 - Undistributed		106,985		106,985				-			-	-
Total		490,021	674,148	1,164,169		179,611	401,943	581,554		13,443	20,335	33,779
Total Power Division	417,543	11,559,278	1,157,677	13,134,498	157,734	6,275,300	550,114	6,983,148	8,671	218,445	26,892	254,008

Water Supply Division - Appendix A-3-a:

Account C-2 - Franchise Water Rights:

The component parts of the charges are made up as follows:

Cost of land transferred to Federal Government under terms of Raker Act	$1,043,961.80
Cost of Percolating Water rights	$ 39,611.00
	$1,083,572.80
Overheads	$ 139,144.74
Sub-total	$1,222,717.54
Payment to Federal Government on account of Roads and Trails	$1,250,000.00
Cost of Construction of Mather Road in Yosemite National Park	$ 206,170.95
Cost of Construction of Trail from O'Shaughnessy Dam to Kale Vernon	$ 56,741.40
Balancing Adjustment	$ 0.11
Total per Account C-2	$2,735,630.00

The above detail shows clearly that the monies expended relate to Franchises and Water Rights and are common to both the Power and Water function - hence, should be assigned to "Joint" use and be allocated in accordance with the determination under that caption.

Account C-5 - Landed Capital:

Source of Water Supply - Account C-5A - represents investments in water shed lands and, as such, is treated as a "Joint" investment between Power and Water.

The assignment of the investment of Right-of-Way, Account C-5D - as between Power and Water was based upon a detail study of the recorded amounts in the Hetch Hetchy Project Property Record book.

The investment in the General Office Land and other at Moccasin - Account C-5E - that is used for both functions is assigned to "Joint".

The direct and Joint assignment of the investment in Roads and Trails - Account C-5F - was predicated upon a study of their mileage, use, and location.

The result on this basis provides approximately 76 per cent of the direct allocations to "Power", as compared to 80 per cent - if the whole Account had been treated as "Joint". The results appear reasonable.

Account C-6 - Buildings:

The investment in the Coast Range Division was assigned to Water. The investment in structures in the Lake Eleanor, Cherry and Lower Cherry Divisions was assigned to Power. The balance, principally in the Hetch Hetchy Division, was assigned to "Joint", as was C-6D - General Office and Other.

Account C-7 - Impounding Dams and Reservoirs:

The O'Shaughnessy Dam, with appurtenances, was raised in 1939 at a capital cost in excess of 4.5 million dollars. The immediate reason and justification was to increase water storage in Hetch Hetchy Reservoir in order to better insure the "firming up" of the installed capacity at Moccasin power plant so that, during periods of low water run-off, the 80,000 kilowatts of installed capacity could operate at a higher annual load factor than would otherwise be possible - thus providing higher electric sales and revenue. Capital assignments were initially worked out on this basis. With the development of the Cherry

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Valley and Lake Eleanor water shed under way and the requirements of water releases to the Modesto and Turlock Irrigation Districts, under the Raker Act, the system of water storage for power and water uses is very complex and interwoven. It is concluded that the whole storage investment in impounding dams for the Hetch Hetchy Reservoir at O'Shaughnessy should be viewed as "Joint", as both the Power and Water Supply functions are participants in the use and benefits resulting therefrom.

Lake Eleanor Division investments are viewed as primary for Power and provide storage water for operation of Early Intake Power Plant.

Account C-8 - Lake and River Cribs:

The investment in the Early Intake Diversion Dam has been allocated to "Joint". Water releases from Hetch Hetchy Reservoir flow 12 miles down the open channel of the Tuolumne River - as well as the lower run-off to that River - and are diverted into the Mountain Tunnel by the Early Intake Dam for Power use at Moccasin and for Hetch Hetchy Water Supply deliveries - as well as water deliveries to the Irrigation Districts. The Early Intake Diversion Dam is classified as "Joint".

The Lower Cherry Division investment is related to the Diversion Dam on the Cherry River and related plant for generation at Early Intake Power Plant and is classified as "Power".

Account C-13 - Canals and Conduits:

The principal item is the large investment in the Mountain Division Tunnel (15.8 miles). One of the principal functions of this tunnel is to make possible the delivery of water at an elevation above the river channel and into the Priest Regulating Reservoir -

the forebay above Moccasin Power Pl nt. The Mountain Tunnel thus makes possible the hydraulic head realized at Moccasin for power generation. The Mountain Tunnel also transports and provides a closed waterway for the Hetch Hetchy Water Supply. The Mountain Tunnel investment and related costs are treated as "Joint".

The investment in the waterway - made up of tunnels, concrete lined canals and pipe sections for transporting the water from the Cherry River to the head works of the Early Intake Power Plant - have been classified as "Power".

It may be further noted that the large investment included under "Balance" (over 66 million dollars) is not broken down and is all assigned to Water. This represents the recorded investment in tunnels, pipe lines, and other waterways used solely for the Water Division, starting in with the Foothill Division, in transporting water to the Bay Region. No further detail is considered necessary for this study.

Account C-24 - General Equipment:

This Account is made up of the usual investment in office, garage and construction equipment. There is also included investment in communication equipment. This Account has been treated as "Joint", as it is used for both the Power and Water Functions.

Account C-25 - Undistributed:

The small amount in this Account not yet classified on the books has been treated as "Joint".

Assignment of Capital Classified as Power Supply on the Books:

The changes under this category, as made in Appendix A-3b, are quite limited. In Account 322, covering the investment in reservoirs,

dams and waterways, there is included facilities in the Moccasin Division to divert the surface run-off from entering the afterbay at the Moccasin plant to insure against possible water contamination, and become part of the water supply that would enter the Foothill Tunnel. Such facilities that have been transferred to Water Supply include the Upper Dam on Moccasin Creek; upper and lower conrete conduits for by-passing the afterbay reservoir water supply; an auxiliary outlet tower; foot bridge; surface drainage system at Moccasin; Grizzly Gulch Diversion Canal; and other miscellaneous items.

In General Plant, Account 371, on Structures and Improvements, the facilities used for both Power and Water Supply were classified as "Joint". These include the Club House; School; Dormitory; Store; Post Office; warehouses; shops; swimming pool; water and sewer system, grading; sidewalks; roads; fencing; and some of the cottages. The cottages that were used by Power Supply personnel were thus assigned.

Under Communication Equipment, Account 378, the telephone circuit from Early Intake to Cherry Dam was classified as Power, and the remainder as "Joint".

Miscellaneous Equipment - in Account 379 - made up essentially of equipment and accessory furnishings in the Club and Cook houses and Cottages, were classified as "Joint".

PRESENT AND ALTERNATE REVENUES
RECORDED BASIS - ADJUSTED YEAR 1952-53
HETCH HETCHY POWER DIVISION

Classification	Sales At Meter Kwhr (a)	Revenue Present Rates (b)	Estimated Increase % (c)	Estimated Increase Alternate Amount (d)	Av. Rate Per Kwhr. Present (e)	Av. Rate Per Kwhr. Alternate (f)
I San Francisco Municipal Load						
1. Railway A.C.	49,490,790	$ 407,993	30.02	$122,499	0.824¢	1.072¢
2. Railway D.C.	27,053,065	302,259	30.67	92,717	1.117	1.460
3. Subtotal Items 1&2	76,543,855	710,252	30.30	215,216	0.928	1.209
4. Street Ltg.	33,406,434	448,994	33.70	151,298	1.344	1.797
5. Traffic Signals	1,887,405	40,100	15.00	6,015	2.125	2.443
6. Subtotal Items 4&5	35,293,839	489,094	32.17	157,313	1.385	1.832
7. Crystal Springs Pumps	14,022,400	113,537	2.19	2,486	0.810	0.827
8. All Other Loads						
a. Airport	19,358,452	162,610	17.14	27,877	0.840	0.984
b. Balance	45,968,344	694,224	13.66	94,830	1.510	1.717
c. Subtotal a & b	65,326,796	856,834	14.32	122,707	1.311	1.500
9. Total San Francisco Municipal Loads	191,186,890	2,169,717	22.94	497,722	1.135	1.395
II Irrigation Loads						
1. Modesto Irrigation Dist.	136,279,200	559,628	10.50	58,759	0.411	0.454
2. Total Irrigation Loads	136,279,200	559,628	10.50	58,759	0.411	0.454
III Commercial Loads (Firm)						
1. Riverbank Ordnance	15,303,302	140,673	-	-	0.919	0.919
2. Permanente Cement	142,704,000	1,103,530	-	-	0.773	0.773
3. Total Commercial-Firm	158,007,302	1,244,203	-	-	0.787	0.787
IV Total Classes I, II & III	485,473,392	3,973,548	14.00	556,481	0.818	0.933
V Other Loads						
1. In Tuolumne County	519,416	5,343	-	-	1,046	-
2. Kaiser Aluminum (Non-Firm)	7,704,000	52,441	-	-	0.681	0.681
3. P.G.&E. Dump Sales	4,239,212	12,294	-	-	0.290	0.290
4. Total Other Lds	12,462,628	70,078	-	-	0.562	0.562
VI System	497,936,020	$4,043,626	13.76	$556,481	0.812¢	0.924¢

PRESENT AND ALTERNATE REVENUES
RECORDED BASIS - ADJUSTED YEAR 1952-53
HETCH HETCHY POWER DIVISION

Classification	Sales at Meter Kwhr	Revenue Present Rates
VII Adjustments		
1. Kaiser Aluminum		
a. Recorded 1952-53	139,872,000	$ 716,270
b. Recorded 1953-54	(7,707,000)	(52,441)
c. Net decrease	132,168,000	663,829
2. P. G. & E. Dump - 1952-53	(4,239,212)	(12,294)
3. Riverbank Ordnance	-	(16,145)
4. Permanente Cement	-	(61,035)
VIII System Recorded	625,864,808	$4,617,981

Alternate Rate Increase is based upon Pacific Gas & Electric Rates per Decision No. 47832 except for service to Modesto - latter predicated on Central Valley rate to Sacramento Utility's District. Resale Rate "R" of Pacific Gas & Electric would result in an increase of approximately $500,000 or 0.784¢ per kwhr.

ALTERNATE REVENUE ESTIMATE IN SUPPORT OF ITEM 8-b - APPENDIX A-4
SAN FRANCISCO MUNICIPAL LOAD - "BALANCE"
12 MONTHS ENDING JUNE 30, 1953

HETCH HETCHY POWER DIVISION

Present Rate	Number of Meters	Alternate Rate	Sales at Meter	Present Revenue	Estimated Increase		Revenue per Kwhr	
					Ratio	Amount	Present Rate	Alternate Rate
	(a)	(b)	(c)	$ (d)	(e)	$ (f)	(g)	(h)
1 - Flat 2.75¢ per kwhr	205	Sch. A-1-S	1,329,042	36,57[illegible]	[illegible]%	8,080.81	2.75¢	3.36¢
2 - Sch. C-1	39	Sch. A-1-S	2,328,876	48,840.05	10.70	5,228.31	2.10	2.32
3 - Sch. C-1	42	Sch. A-13-S	28,286,680	338,500.90	12.03	40,734.64	1.20	1.34
4 - Subtotal Sch. C-1	81		30,[illegible]	[illegible]	11.87	[illegible]	1.[illegible]	1.42
5 - Sch. C-6	7	Sch. A-6-S	[illegible]	3,235.[illegible]	11.00	[illegible]0.64	3.0[illegible]	3.41
6 - Sch. C-6	2	Sch. [illegible]	1,010,1[illegible]	[illegible].11	[illegible]	1,[illegible]	1.[illegible]7	1.39
7 - Subtotal Sch. C-6	9		1,117,[illegible]	[illegible].77	1[illegible].0[illegible]	1,[illegible]	1.44	1.58
8 - Sch. D-1	4	Sch. D-1-S	[illegible]	444.54	17.40	77.38	[illegible]	1.59
9 - Sch. D-5	2	Sch. D-5-S	[illegible],30[illegible]	119.[illegible]	20.[illegible]	[illegible]	2.77	3.34
10 - Sch. D-6	[illegible]	Sch. D-6-S	[illegible],112	1,[illegible]	18.74	[illegible].10	1.86	[illegible].20
11 - Sch. DM-1	2	Sch. DM-1-S	[illegible],246	[illegible]	[illegible].58	11[illegible].57	1.[illegible]	2.37
12 - Sch. L-1	17[illegible]	Sch. A-1-S	5,[illegible],172	[illegible]	12.00	15,07[illegible]	2.[illegible]7	2.[illegible]
13 - Sch. L-5	2	Sch. A-5-S	[illegible],832	1,[illegible].33	13.[illegible]	[illegible]	3.14	3.58
14 - Sch. L-6	15	Sch. A-6-S	16[illegible],090	5,[illegible]	14.43	[illegible].13	3.36	3.84
15 - Sch. L-21	2	Sch. A-6-S	[illegible]	16[illegible].89	40.31	[illegible].13	3.94	5.53
16 - Flat 2.0 Cents	188	Sch. P-1-S	1,811,999	36,239.98	36.10	13,082.27	2.00	2.72
17 - Sch. E-1	4	Sch. E-1-S	173,846	2,249.84	23.18	521.40	1.29	1.59
18 - Sch. P-1	10	Sch. P-1-S	226,383	4,789.62	13.72	657.33	2.12	2.41
19 - Sch. P-3	8	Sch. PA-1-S	1,634,960	22,463.08	16.8[illegible]	3,779.23	1.37	1.61
20 - Sch. P-5	1	Sch. A-13-S	847,270	15,912.44	2.04	323.91	1.88	1.92
21 - Sch. P-15	4	Sch. P-3-S	254,000	4,480.07	10.[illegible]	490.97	1.76	1.95
22 - Sch. P-15	6	Sch. A-13-S	2,07[illegible],440	28,28[illegible].32	9.70	2,744.74	1.36	1.49
23 - Subtotal Sch. P-15	10		2,331,430	32,765.39	9.88	3,235.71	1.41	1.54
24 - Sch. P-17	1	Sch. P-5-[illegible]	187,750	3,668.96	19.88	729.39	1.95	2.34
25 - Subtotal			[illegible],371	623,[illegible]03.71		94,617.96		
26 - Deficiency (unaccounted)*			4[illegible],973	1,020.29		213.96		
27 - Total			[illegible],344	$624,224.00	15.6[illegible]%	$94,830.00	1.[illegible]	1.72

* Difference is probably involved with Flat rate group of 200 accounts. There is also St. Ltg. account L-35 - not included.

ALTERNATE-SINGLE PURPOSE STEAM ELECTRIC PLANT COSTS
HETCH HETCHY POWER DIVISION

Item		One 80,000 Kw (Thousands	Three 40,000 Kw of Dollars)
Capital Costs			
Steam Plant			
Investment at $100 per Kw		8,000	12,000
Transmission		100	100
Substation		480	600
Subtotal		8,580	12,700
General Capital		200	200
Subtotal		8,780	12,900
Working Capital		500	500
Total		9,280	13,400
Annual Costs			
Production			
Fuel Cost			
Barrels of fuel Oil - 1,112,000 at $1.90 per bbl. (517,000 M Kwhr at 465 Kwhr per bbl.)		2,112	2,112
Operation and Maintenance			
$5.00 per Kw		400	
$4.00 Per Kw			480
Transmission & Switching			
Operation and Maintenance			
3.5% on $580,000		20	
3.5% on $700,000			24
Transmission Rents		54	54
Taxes and Insurance			
0.5% on $8,580,000		43	
0.5% 12,700,000			64
Depreciation & Replacement			
4% S.F. - 35 yr. life	.0136		
Interim Replacement	.0050		
$8,500,000 at	.0186	160	
12,700,000 at	.0186		236
Interest			
4% on $9,280,000		371	
4% on $13,400,000			536
Total Annual Costs		3,160	3,506
Other Costs			
Purchase of Supplemental Kwhr (28,630,472)		253	253
Wheeling and Rental Payment		950	950
Administrative and General		263	263
Customer Accounting		14	14
Total Indicated Annual Costs		4,640**	4,986*

* An estimate with 3 - 40,000 Kw units provides the required capacity with one unit down. This additional unit with attending annual costs would probably just about carry itself. However some supplemental purchases and stand by would be required at a proportionate higher cost than with single unit operation.

** While the costs from this alternate power source are sufficiently close to the gross benefits of - to repeat "- - sufficiently close to the gross benefits of 4,600,000 - to use either - the lower of the two costs, as required, will be used.

ALTERNATE-SINGLE PURPOSE WATER PROJECT COSTS

HETCH HETCHY WATER DIVISION

Item		Amount
Annual Costs of Operation:		
Production:		
Operation	$ 59,300	
Maintenance	100,100	
Total		159,400
Transmission:		
Operation	40,100	
Maintenance	56,400	
Total		96,500
Total - Production and Transmission		255,900
Administrative & General:		
46% of 351,300		88,500
Taxes - Property		12,000
Fee paid to U.S. 2/3 of 30,000		20,000
Depreciation		483,600
Interest:		
4% on $89,146,000		3,566,000
Indicated Total Annual Costs		$4,426,000
Fixed Capital:		
Acct.		
C-2 Franchise and Water Rights		$2,735,630
C-5 Land Capital		824,818
C-6 Buildings		145,427
C-7 O'Shaughnessy Dam - initial	$11,807,772	
Diversion Dam - Single Purpose	890,000	
Total		12,697,772
C-13 Canals and Conduits		
6.4 miles concrete lined tunnel	$ 4,390,000	
Foothill, San Joaquin, Coast Range and Bay Crossing Divisions	68,019,834	
Total		72,409,834
C-16 Purification		37,314
C-24 General Equipment		188,000
Total Indicated Single Purpose Investment		$89,145,839
Use		$89,146,000

A-P-P-E-N-D-I-X B

SUMMARY OF ANNUAL EXPENSES OF OPERATION
AFTER ALLOCATION OF JOINT EXPENSES
POWER - 80% - WATER - 20% - ADJUSTED YEAR 1952-53
ADJUSTED YEAR ENDING JUNE 30, 1953
HETCH HETCHY POWER AND WATER DIVISIONS

Item	Power $	Water $	Total $
Production			
Purchase Power	252,646		252,646
Balance - Opr. & Maintenance	360,490	79,655	440,145
Subtotal	613,136	79,655	692,791
Transmission			
Operation & Maintenance	236,494	63,037	299,531
Distribution			
Operation	196	195	391
Wheeling Charge	949,977	-	949,977
Commercial	14,000	-	14,000
Administrative & General	263,470	87,823	351,293
Depreciation	584,414	1,125,925	1,710,339
Taxes - Property	8,220	12,020	20,240
Fee Paid Fed. Gov.	24,000	6,000	30,000
Total Expenses - Adjusted Year	2,693,907	1,374,655	4,068,562

NOTE:

Based upon the River Basin developed percentages all "Joint Expenses" in Appendix A-2 have been assigned, 80% to Power and 20% to Water Supply.

RATE BASE DEVELOPMENT
YEAR ENDED JUNE 30, 1953
HETCH HETCHY POWER AND WATER DIVISIONS

	Power	Water	Joint	Total
1 - Average Capital	$13,858,570	$67,127,191	$36,891,887	$117,877,648
2 - Allocation of Joint Capital				
3 - 80% of 36,891,887	29,513,510			
4 - 20% of 36,891,887		7,378,377		
5 - Subtotal	43,372,080	74,505,568		117,877,648
6 - Reserve for Depreciation	7,099,665	15,431,795	6,949,516	29,480,976
7 - Allocation Joint Reserve				
8 - 80% of 6,949,516	5,559,613			
9 - 20% of 6,949,516		1,389,903		
10- Subtotal	12,659,278	16,821,698		29,480,976
11- Net Plant Capital (5-10)	30,712,802	57,683,870		88,396,672
12- Working Capital				
Working Cash	300,000	50,000		350,000
Materials & Supplies	20,000	26,000		46,000
	320,000	76,000		396,000
13- Rate Base (11 plus 12)	$31,032,802	$57,759,870		$88,792,672
14- Rate Base - used	$31,033,000	$57,760,000		$88,793,000

A-P-P-E-N-D-I-X C

ANNUAL SYSTEM LOAD FACTOR - ADJUSTED BASIS
YEAR - 1952-53
HETCH HETCHY POWER DIVISION

Actual year 1952-53 adjusted for change in Kaiser Aluminum load - from 142,704,000 Kwhr to 7,704,000 Kwhr in 1953-54. The adjusted year basis is taken at the 1953-54 level of operation.*

The system annual load factor is based upon the coincidental system peak. Under the adjusted conditions - the peak demand would have occurred in January 1953 between 5:30 and 6:00 P.M. The computation for the coincidental peak demand and annual load factor are as follows:

1	- Total Newark Demand - including Riverbank - Kw	75,450**
2	- City Demand at Newark	44,100
3	- Permanente Cement plus Kaiser Aluminum	29,000
4	- Non-Simultaneous Max. Demand - Permanente Cement	17,227
5	- Non-Simultaneous Max. Demand - Kaiser Aluminum	12,771
6	- Line 5/ Line 4 time (Line 4 plus Line 5)	0.4257
7	- Kaiser's contribution to System Peak (0.4257 by 29,000)	12,350
8	- Kaiser's Non-Simultaneous Max. Kw during 1953 - 54	1,920
9	- Line 8/ Line 5	0.15034
10	- Kaiser's Contribution to System Peak Adjusted (0.15034 by 12350)	1,860
11	- Total Newark Demand - Adjusted (Line 1 less Line 7 plus Line 10)	64,960
12	- Districts (MID) Demand at meter	22,080
13	- Hetch Hetchy loss to M I D	662
14	- Hetch Hetchy loss to Serve Riverbank Ordnance (3% of 2350)	70
15	- Hetch Hetchy loss to Serve loads at Newark	3,403
16	- Max. Adjusted Coincident System Demand (Lines 11 to 15)	91,175***
17	- Ditto Line 16 Less Kaiser Al. Demand of 1860	89,315
18	- System Average Demand - exclusive of "Other Loads" but including Kaiser Aluminum	62,892
19	- Ditto Line 18 but excluding Kaiser Aluminum	61,897
20	- System Annual Load Factor - with Kaiser	69.0-%
21	- System Annual Load Factor - excluding Kaiser	69.3 %

* Also reflects change in Wheeling contract for S.F. International Airport - Kwhr factor reduced from 1.25 to 1.17.

** Includes demand of 2350 Kw at meter for Riverbank Plant

*** The Maximum System Coincidental Demand for the year 1952-53, occurred in October in the amount of 105,277 Kw - the corresponding demand in January 1953 was 101,815 Kw.

KILOWATT HOUR DELIVERIES - ADJUSTED BASIS
YEAR 1952-53
HETCH HETCHY POWER DIVISION

Classification	At Meter	Ratio	At Newark	Hetch Hetchy Losses	Total Requirements
	(a)	(b)	(c)	(d)	(e)
I San Francisco Municipal Loads					
1. Railway A.C.	49,490,790	1.10617	54,745,227	2,724,228	57,469,455
2. Railway D.C.	27,053,065	1.28000	34,627,924	1,722,693	36,350,617
3. Total	76,543,855		89,373,151	4,446,921	93,820,072
4. Street Lighting	33,406,434	1.12903	37,715,531	1,851,835	39,567,366
5. Traffic Signals	1,887,405	1.12903	2,130,937	104,630	2,235,567
6. Total (550,609-Newark) (540,429-Meter)	35,293,839		39,846,468	1,956,465	41,802,933
7. Crystal Springs Pumps	14,022,400	1.11428	15,624,878	787,908	16,412,786
8. All Other Loads			(Sheet 540504)		
a. Airport(540429)Meter	19,358,452	1.17000	22,649,388	1,123,857	23,773,245
b. Balance " "	45,968,344	1.25000	57,460,431	2,842,012	60,302,443
c. Total " "	65,326,796		80,109,819	3,965,869	84,075,688
9. Total Municipal (540429 Meter)	191,186,890		224,954,316	11,157,163	236,111,479
II Irrigation District Loads					
1. Modesto - Total	136,279,200	1.0000	136,279,200	3,543,259	139,822,459
III Commercial Loads					
1. Riverbank Ordnance	15,303,302	1.0020	15,333,446	142,663	15,476,109
2. Permanente Cement	142,704,000	1.0110	144,273,744	6,530,229	150,803,973
3. Total	158,007,302		159,607,190	6,672,892	166,280,082
IV Total Classes I, II & III	485,473,392		520,840,706	21,373,314	542,214,020
V Other Loads					
1. In Tuolumne County	519,416	1.0000	519,416	15,582	534,998
2. Kaiser Aluminum	7,704,000	1.0000	7,704,000	172,124	7,879,124
3. Dump Sales to P.G.&E.	4,239,212	1.0000	4,239,212	237,266	4,476,478
Total	12,462,628		12,462,628	427,972	12,890,600
VI System - Sales					
1. Total Adjusted 1952-53 year	497,936,020		533,303,334	21,801,286	555,104,620

KILOWATT HOUR DELIVERIES - ADJUSTED BASIS
YEAR 1952-53
HETCH HETCHY POWER DIVISION

Classification		At Meter (a)
VII Kaiser Aluminum adjustment		
1. Actual 1952-53	139,872,000	
2. 1953-54 year	7,704,000	
3. Difference		132,168,000
4. Dump Sales to P.G.&E.-a credit		(4,239,212)
VIII Total System Sales - Recorded		625,864,808

"Ratio factors are in accordance with "Wheeling Agreement" contract for Municipal Loads and, as such, probably provide for more than line losses. This would result in Municipal Loads carrying a greater allocation burden - particularly Item 8-b - "Balance". - than Non-Municipal loads.

Hetch Hetchy line losses from Moccasin to Modesto have been computed and the same percentage applied to Riverbank. The remaining losses from Moccasin to Newark have been distributed as between the classes in relation to the Hetch Hetchy deliveries at Newark.

Supplemental Pacific Gas and Electric purchases carry no losses, as such deliveries are of Newark.

[illegible]

DEMAND CALCULATIONS

EXPLANATORY TO APPENDIX C-3-a

NON-SIMULTANEOUS DEMANDS

Records afforded good material for the development of demands. Maximum demands were determined for each of the customer groups and sub-groups for each month of the test year.

Demands were derived from billing records in case of the following customer classes.:

San Francisco Municipal Loads:

Railway A.C.

Railway D.C.

Street Lighting (partly estimated)

Crystal Springs Pumps

San Francisco International Airport

Irrigation Districts:

Modesto and Turlock

Commercial Loads:

Riverbank Ordnance

Kaiser Aluminum & Chemical Corporation

Permanente Cement

For Municipal Loads - "Balance".

Demands applicable to these Miscellaneous Municipal uses were broken down by Rate Schedules under which the service is billed. These were divided into three groups, as follows:

1 - Demand Schedules: C-1,C-6,P-5,P-15 and P-17

2 - Connected Load Schedules: P-1, P-2, and P-3-13

3 - Energy Schedules: D-1,D-5,D-6,DA-6,L-1,L-5,L-6,L-21,H-1 and flat rate charges .02¢ and 2.75¢.

Demands under the first group are recorded, other demands were estimated.

Demands shown under the Connected Load Schedules were derived from the connected horsepower load, assuming 75% efficiency and an average motor loading of 75% of name plate rating.

Quantities of energy for which demands were estimated amount to approximately 2% of all energy accounted for.

In making the summation for the Municipal Loads "Balance", the coincident maximum demand of the group was not used - rather the sum of the maximum non-simultaneous demands by Rate Schedule groups was used.

ALLOCATION OF HETCH HETCHY LINE LOSSES IN KW TO NEWARK LOADS - ADJUSTED 1952-53
HETCH HETCHY POWER DIVISION

I San Francisco Municipal Load		Non-Simultaneous At Newark (Equivalent) (1)	Hetch Hetchy Losses* 5.3% of (1) (2)	Non-Simultaneous Demand With Losses (3)	%
1 - Railway - A.C.		14,597	774	15,371	11.77
2 - Railway - D.C.		10,563	560	11,123	8.52
3 - Subtotal (1 & 2)		25,160	1,334	26,494	20.29
4 - Street Lighting		9,591	508	10,099	7.73
5 - Traffic Signals		266	14	280	.21
6 - Subtotal (4 & 5)		9,857	522	10,379	7.94
7 - Crystal Springs Pumps		2,208	117	2,325	1.78
8 - All Other Loads					
a - Airport		5,237	278	5,515	4.22
b - Balance		26,216	1,389	27,605	21.14
c - Subtotal - (8)		31,453	1,667	33,120	25.36
9 - Total S.F. Municipal		68,678	3,640	72,318	55.37
II Irrigation Districts					
1 - Total		33,120	994**	34,114	26.11
III Commercial Loads	Total Demands	Supplied By H. H.	H.H. Losses		
1 - Riverbank Ordnance	4,798	1,717	52**	4,850	3.71
2 - Permanente Cement	18,459	16,608	880	19,339	14.81
3 - Total (1 & 2)	23,257	18,325	932	24,189	18.52
IV Total, Items I and II	91,935	87,003	4,634	106,432	81.48
V Total Items I, II and III	125,055	120,123	5,566	130,621	100.00

* Hetch Hetchy deliveries at Newark (62,610 Kw) with Hetch Hetchy loss of 3623 for January 1953 (3623/62610=5.78%) at time of System peak demand of 91,325 Kw.

** Losses to M I D and Riverbank computed at 3%.

Appendix C-3-b

CLASS DEMAND DEVELOPMENT IN SUPPORT APPENDIX C-3a
SAN FRANCISCO MUNICIPAL LOAD-"BALANCE"
12 MONTHS ENDING JUNE 30, 1953
HETCH HETCHY POWER DIVISION

Classification	Annual Sales In Kilowatt Hours At Meter (a)	Ratio (b)	At Newark (c)	Percent (d)	Average Demand Kw (c) ÷ 8,760 (e)	Non-Simultaneous Kw Demand Newark (f)	PerCent (g)	Excess Demand Kw (f)-(e) (h)	Percent (i)	Annual Load Factor (e)/(f) (j)
1 - 2.75 c Flat Rate	1.329,942	1.25	1,662.428	2.89	189.9	1,044	3.98	854.2	4.33	18.17
2 - C-1	30.615.556	1.25	38.269.445	66.67	4.368.7	14,608	55.66	10,239.3	52.00	29.91
3 - C-6	1,117.436	1.25	1.396,795	2.43	159.5	561	2.14	401.5	2.04	28.42
4 - D-1	32.828	1.25	41,035	.07	4.7	19	.07	14.3	.07	24.74
5 - D-5	4.305	1.25	5.382	.01	.6	3	.01	2.4	.01	20.00
6 - D-6	58.112	1.25	72.640	.13	8.3	29	.11	20.7	.11	28.62
7 - DA-6	26,246	1.25	32.808	.06	3.8	12	.05	8.2	.04	31.67
8 - L-1	5.299.172	1.25	6.623,965	11.54	756.2	3,840	14.63	3,083.8	15.66	19.69
9 - L-5	50.832	1.25	63.540	.11	7.3	30	.11	22.7	.12	24.33
10 - L-6	167.090	1.25	208,862	.36	23.8	94	.36	70.2	.36	25.32
11 - L-21	4.284	1.25	5,355	.01	.6	3	.01	2.4	.01	20.00
12 - 2.0 c Flat Rate	1,811.999	1.25	2.264,999	3.95	258.6	1,783	6.79	1,524.4	7.74	14.50
13 - E-1	173,846	1.25	217.307	.38	24.8	81	.31	56.2	.29	30.62
14 - P-1	226,383	1.25	282.979	.49	32.3	123	.47	90.7	.46	26.26
15 - P 3,-13	1,634,960	1.25	2,043,700	3.56	233.3	1.508	5.74	1,274.7	6.47	15.47
16 - P-5	847,200	1.25	1,059,000	1.84	120.9	1,350	5.14	1,229.1	6.24	8.96
17 - P-15	2,331,430	1.25	2,914,287	5.08	332.7	1,020	3.89	687.3	3.49	32.62
18 - P-17	187,750	1.25	234,688	.41	26.8	91	.35	64.2	.33	29.45
19 - Subtotal	45,919,371	1.25	57,399,215		6,552.7	26,199		19,646.3		25.01
20 - Unaccounted for	48,973		61,216		7.0	17		10.0		
21 - Total - Other Municipal	45,968,344		57,460,431		6,559.7	26,216		19,656.3		

COST ALLOCATIONS - TO MUNICIPAL LOADS
ITEM 8(b) - TABLE 7
HETCH HETCHY POWER DIVISION

In the table of Cost Development that follows - Appendix C-4a, Unit Demand, Commodity and Customer Costs are first determined for this balance of the Municipal Loads as a whole - under the heading 1 - Unit Cost Determination; and under the second section, marked 2 - Unit Costs By Rate Schedules - under which total dollars are allocated to each rate schedule group.

Under Unit Cost Determination, the total dollars for this group by the three cost components and by Power and Distribution Pool subdivisions have been transferred from Table 6 where they were developed. New unit costs have been computed, based upon Kilowatt hours and demands at Kewark. In the System Allocations in Table 6, the quantities were converted to the equivalent deliveries at transmission input (a combination of Hetch Hetchy deliveries to transmission at Moccasin and Pacific Gas and Electric deliveries at Newark).

Thus, under Section 2 of Appendix C-4a, the total assigned costs for each of the rate schedule groups are developed. These dollar amounts and unit costs have been transferred to Table 7 under Section I 8-b - Columns (b), (c), (e) and (f).

SEGREGATION OF ITEM 8(b) - BALANCE MUNICIPAL LOADS IN SUPPORT OF TABLE 7 - 1952-53 ADJUSTED YEAR HETCH HETCHY POWER DIVISION

1. UNIT COST DETERMINATIONS (Referred To Newark Quantities)

	With 4.35% Return	With 5.7% Return
Demand Allocations		
Power Pool	$254,047	$291,561
Distribution Pool	114,696	114,696
Total Demand Allocation	368,743	406,257
Unit Cost based on 19,646.3 Kw (excess)	$ 18.7691	$ 20.6786
Commodity Allocations		
Power Pool	$212,802	$246,376
Distribution Pool	255,290	255,290
Total Commodity Allocation	468,092	501,666
Unit Cost based on 57,399,215 Kwhr	0.81550¢	0.87399¢
Customer Allocations		
Power Pool	-	-
Distribution Pool	$ 48,380	$ 48,380
Unit Cost based on 1362 Equiv. Customers	$ 35.52	$ 35.52

2. UNIT COSTS BY RATE SCHEDULES

	Basic Quantities	With 4.35% Return Unit Cost	With 4.35% Return Total Cost	With 5.7% Return Unit Cost	With 5.7% Return Total Cost
2.75¢ Flat Rate					
Demand (Excess) Kw	854.2	$18.77	$ 16,033	$20.68	$ 17,664
Commodity Kwhr	1,662,428	0.816¢	13,557	0.874¢	14,529
Customer (Equivalent)	295	$35.52	10,479	$35.52	10,479
Total			40,069		42,672
Unit Cost per Kwhr Sold	1,329,942	3.013¢		3.209¢	
Schedule C-1					
Demand (Excess) Kw	10,239.3	$18.77	$192,183	$20.68	$211,733
Commodity	38,269,445	0.816¢	312,087	0.874¢	334,471
Customer (Equivalent)	405	$35.52	14,386	$35.52	14,386
Total			518,656		560,590
Unit Cost per Kwhr Sold	30,615,556	1.694¢		1.831¢	
Schedule C-6					
Demand (Excess) Kw	401.5	$18.77	$ 7,535	$20.68	$ 8,302
Commodity Kwhr	1,396,795	0.816¢	11,391	0.874¢	12,208
Customer (Equivalent)	45	$35.52	1,598	$35.52	1,598
Total			20,524		22,108
Unit Cost per Kwhr Sold	1,117,436	1.837¢		1.978¢	

SEGREGATION OF ITEM 8(b) - BALANCE MUNICIPAL LOADS IN SUPPORT OF TABLE 7 - 1952-53 ADJUSTED YEAR HETCH HETCHY POWER DIVISION

	Basic Quantities	With 4.35% Return Unit Cost	With 4.35% Return Total Cost	With 5.7% Return Unit Cost	With 5.7% Return Total Cost
2. UNIT COST BY RATE SCHEDULES (Continued)					
Schedule D-1					
Demand (Excess) Kw	14.3	$18.77	$ 268	$20.68	$ 296
Commodity Kwhr	41,035	0.816¢	335	0.874¢	359
Customer (Equivalent)	4	$35.52	142	$35.52	142
Total			745		797
Unit Cost per Kwhr Sold	32,828	2.269¢		2.428¢	
Schedule D-5					
Demand (Excess) Kw	2.4	$18.77	$ 45	$20.68	$ 50
Commodity Kwhr	5,382	0.816¢	44	0.874¢	47
Customer (Equivalent)	2	$35.52	71	$35.52	71
Total			160		168
Unit Cost per Kwhr Sold	4,305	3.717¢		3.902¢	
Schedule D-6					
Demand (Excess) Kw	20.7	$18.77	$ 389	$20.68	$ 428
Commodity Kwhr	72,640	0.816¢	592	0.874¢	635
Customer (Equivalent)	9	$35.52	320	$35.52	320
Total			1,301		1,383
Unit Cost per Kwhr Sold	58,112	2.239¢		2.380¢	
Schedule DA-6					
Demand (Excess) Kw	8.2	$18.77	$ 154	$20.68	$ 170
Commodity Kwhr	32,808	0.816¢	268	0.874¢	287
Customer (Equivalent)	3	$35.52	107	$35.52	107
Total			529		564
Unit Cost per Kwhr Sold	26,246	2.016¢		2.149¢	
Schedule L-1					
Demand (Excess) Kw	3,083.8	$18.77	$ 57,880	$20.68	$ 63,769
Commodity Kwhr	6,623,965	0.816¢	54,018	0.874¢	57,893
Customer (Equivalent)	267	$35.52	9,484	$35.52	9,484
Total			121,382		131,146
Unit Cost per Kwhr Sold	5,299,172	2.291¢		2.475¢	

SEGREGATION OF ITEM 8(b) - BALANCE MUNICIPAL LOADS
IN SUPPORT OF TABLE 7 - 1952-53 ADJUSTED YEAR
HETCH HETCHY POWER DIVISION

	Basic Quantities	With 4.35% Return Unit Cost	With 4.35% Return Total Cost	With 5.7% Return Unit Cost	With 5.7% Return Total Cost
2. UNIT COST BY RATE SCHEDULES (Continued)					
Schedule L-5					
Demand (Excess) Kw	22.7	$18.77	$ 426	$20.86	$ 469
Commodity Kwhr	63,540	0.816¢	518	0.874¢	555
Customer (Equivalent)	3	$35.52	107	$35.52	107
Total			1,051		1,131
Unit Cost per Kwhr Sold	50,832	2.068¢		2.225¢	
Schedule L-6					
Demand (Excess) Kw	70.2	$18.77	$ 1,318	$20.68	$ 1,452
Commodity Kwhr	208,862	0.816¢	1,703	0.874¢	1,825
Customer (Equivalent)	23	$35.52	817	$35.52	817
Total			3,838		4,094
Unit Cost per Kwhr Sold	167,090	2.297¢		2.450¢	
Schedule L-21					
Demand (Excess) Kw	2.4	$18.77	$ 45	$20.68	$ 50
Commodity Kwhr	5,355	0.816¢	44	0.874¢	47
Customer (Equivalent)	3	$35.52	107	$35.52	107
Total			196		204
Unit Cost per Kwhr Sold	4,284	4.575¢		4.762¢	
2.0¢ Flat Rate					
Demand (Excess) Kw	1,524.4	$18.77	$ 28,612	$20.68	$ 31,522
Commodity Kwhr	2,264,999	0.816¢	18,471	0.874¢	19,796
Customer (Equivalent)	188	$35.52	6,678	$35.52	6,678
Total			53,761		57,996
Unit Cost per Kwhr Sold	1,811,999	2.967¢		3.201¢	
Schedule H-1					
Demand (Excess) Kw	56.2	$18.77	$ 1,055	$20.68	$ 1,162
Commodity Kwhr	217,307	0.816¢	1,772	0.874¢	1,899
Customer (Equivalent)	10	$35.52	355	$35.52	355
Total			3,182		3,416
Unit Cost per Kwhr Sold	173,846	1.830¢		1.965¢	
Schedule P-1					
Demand (Excess) Kw	90.7	$18.77	$ 1,702	$20.86	$ 1,876
Commodity Kwhr	282,979	0.816¢	2,308	0.874¢	2,473
Customer (Equivalent)	25	$35.52	888	$35.52	888
Total			4,898		5,237
Unit Cost per Kwhr Sold	226,383	2.164¢		2.313¢	

SEGREGATION OF ITEM 8(b) - BALANCE MUNICIPAL LOADS
IN SUPPORT OF TABLE 7 - 1952-53 ADJUSTED YEAR
HETCH HETCHY POWER DIVISION

	Basic Quantities	With 4.35% Return Unit Cost	With 4.35% Return Total Cost	With 5.7% Return Unit Cost	With 5.7% Return Total Cost
2. UNIT COST BY RATE SCHEDULES (Continued)					
Schedule P-3-13					
Demand (Excess) Kw	1,274.7	$18.77	$ 23,925	$20.68	$ 26,359
Commodity Kwhr	2,043,700	0.816¢	16,666	0.874¢	17,862
Customer (Equivalent)	20	$35.52	710	$35.52	710
Total			41,301		44,931
Unit Cost per Kwhr Sold	1,634,960	2.526¢		2.748¢	
Schedule P-5					
Demand (Excess) Kw	1,229.1	$18.77	$ 23,069	$20.68	$ 25,416
Commodity Kwhr	1,059,000	0.816¢	8,636	0.874¢	9,256
Customer (Equivalent)	5	$35.52	178	$35.52	178
Total			31,883		34,850
Unit Cost per Kwhr Sold	847,200	3.763¢		4.114¢	
Schedule P-15					
Demand (Excess) Kw	687.3	$18.77	$ 12,900	$20.68	$ 14,212
Commodity Kwhr	2,914,287	0.816¢	23,766	0.874¢	25,471
Customer (Equivalent)	50	$35.52	1,776	$35.52	1,776
Total			38,442		41,459
Unit Cost per Kwhr Sold	2,331,430	1.649¢		1.778¢	
Schedule P-17					
Demand (Excess) Kw	64.2	$18.77	$ 1,205	$20.68	$ 1,328
Commodity Kwhr	234,688	0.816¢	1,914	0.874¢	2,051
Customer (Equivalent)	5	$35.52	178	$35.52	178
Total			3,297		3,557
Unit Cost per Kwhr Sold	187,750	1.756¢		1.895¢	